LEVEL METER D2007

6 kHz to 18.6 MHz

Technical Manual

S45034-D2007-B102-51-7618

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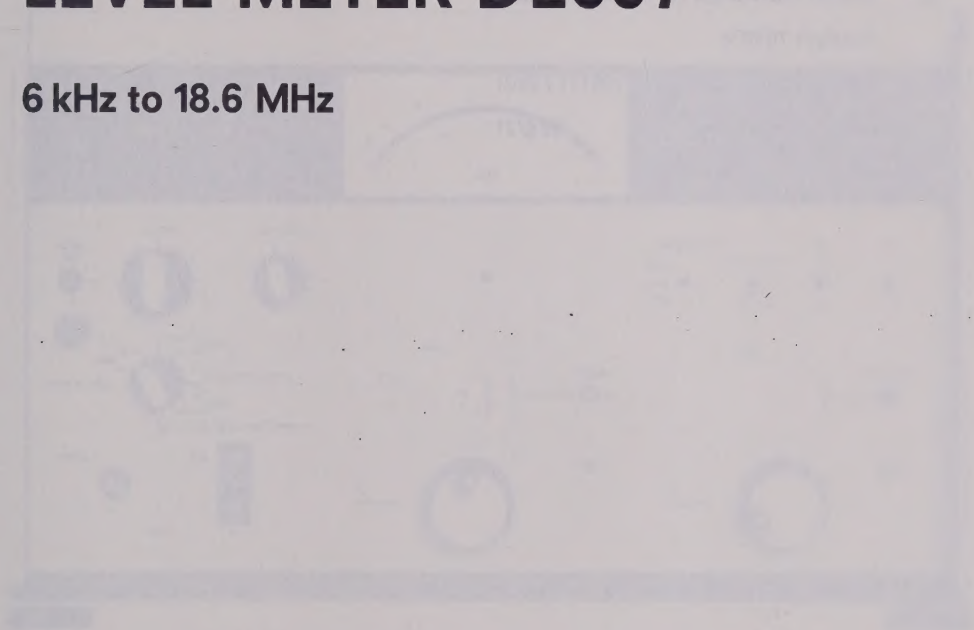

Technical Manual

S45034–D2007–B102–51–7618

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Bereich Weitverkehrstechnik, Nachrichtenmeßgeräte

D-8000 MÜNCHEN 70, Schertlinstraße 8

Postfach 700076

Fernsprecher / Telephone: (0811) 72001

Fernschreiber / Telex: 524721

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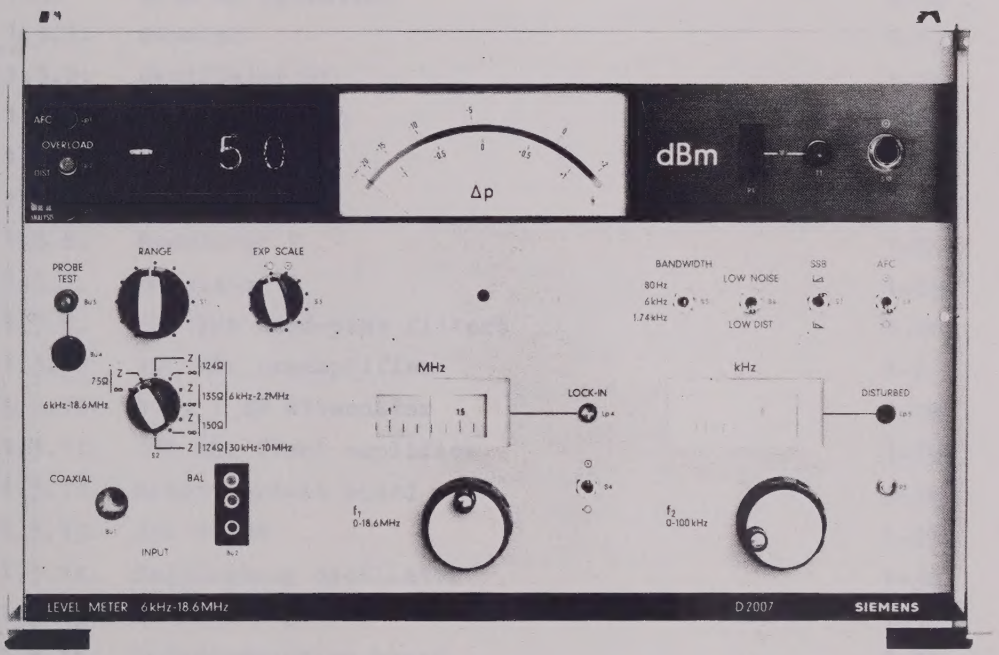
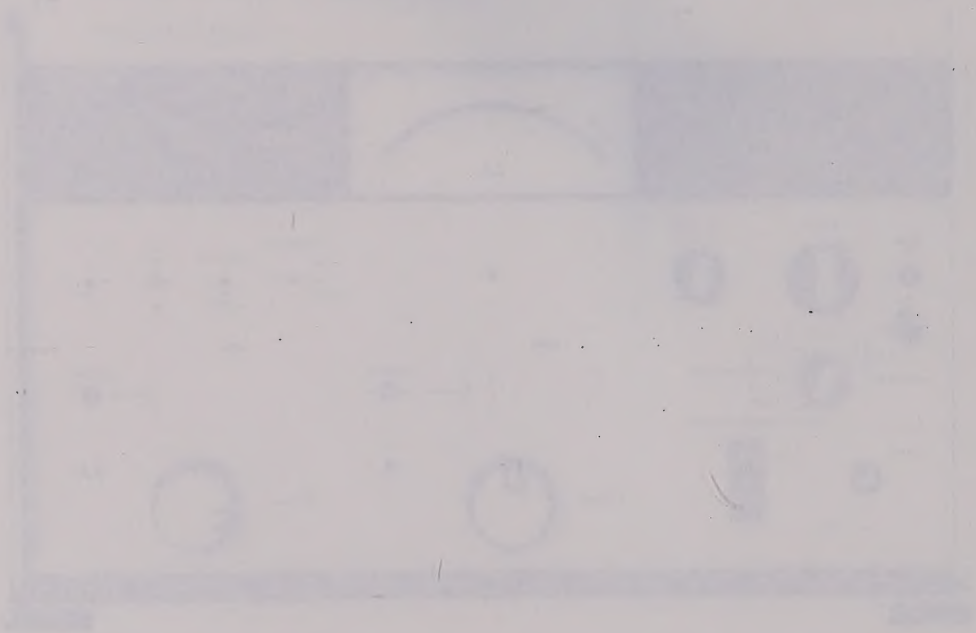


Pegelmesser D2007

LEVEL METER

6 kHz bis 18.6 MHz

This description of level meter D2007 applies to models -B102-, -B204-, -C102-, -C204-.



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1. Description

1.1. Application

1.1.1. General

Level Meter D2007 was developed for carrying out measurements on coaxial test items in the frequency range 6 kHz to 18.6 MHz and for measurements on balanced test items in the frequency range 6 kHz to 2.2 MHz and 30 kHz to 10 MHz.

The level meter can be used for measurements on both balanced systems having up to 120 and 240 channels as well as coaxial systems with up to 2700 and 3600 channels and carrier frequency television bands.

Point by point measurements and measurements with automatic frequency variation, i.e. measurements with swept frequency, can also be carried out with the same accuracy.

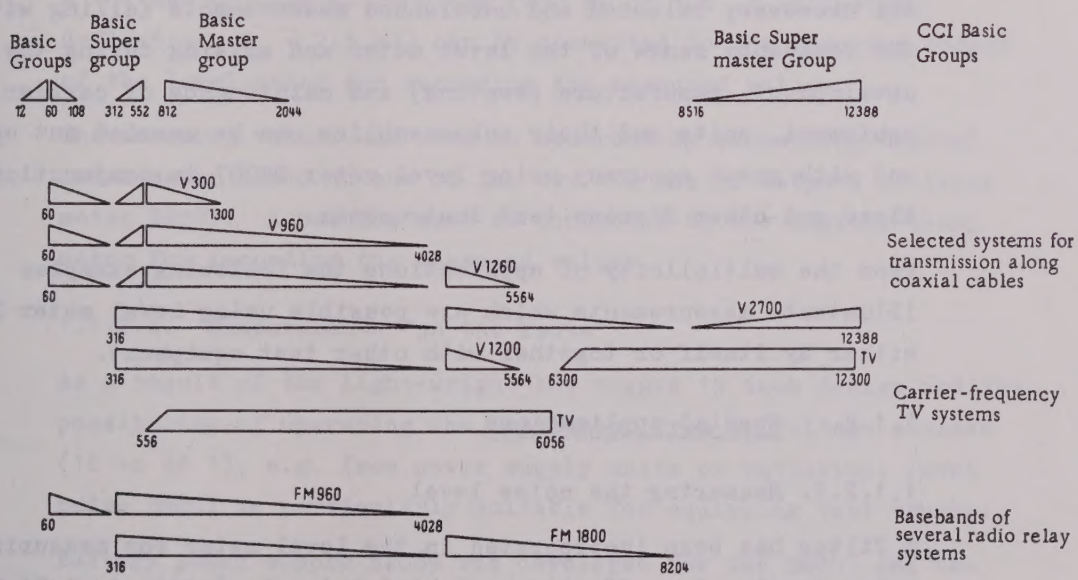


Fig. 1 Summary of some transmission systems within the frequency range of Level Meter D2007

The particular advantages of the level meter are:

universal applicability,
high measuring accuracy,
high frequency accuracy and stability,
simple operation.

Balanced and coaxial measurements at various impedances, measurements with bandwidths of 80 Hz, 1.74 and 6 kHz, with expanded level indication, crystal-accurate frequency locking, and automatic frequency control (AFC) can be carried out in "low noise" and "low distortion" operation modes of the D2007 over a measuring range of 140 dB (dBm).

An overload indication shows whether the level meter is overloaded when meauring harmonic distortion and spurious radiations.

Level oscillator W2007, spot frequency generator G2031, sweep oscillators G2025 and G2026 and battery power supply B2069 were developed especially for level meter D2007.

All necessary balanced and unbalanced measurements falling within the frequency range of the level meter and arising during the development, manufacture (testing) and maintenance of carrier systems, equipment, units and their subassemblies can be carried out optimally and with great accuracy using level meter D2007 in conjunction with these and other Siemens test instruments.

From the multiplicity of applications the following examples illustrate measurements which are possible using level meter D2007 either by itself or together with other test equipment.

1.1.2. Special applications

1.1.2.1. Measuring the noise level

A filter has been incorporated in the level meter for measuring the noise level. Its effective weighted noise bandwidth is 1.74 kHz and its stop-band attenuation is greater than 80 dB at a spacing of 2 kHz from the filter center frequency.

Besides the customary level measurements this filter can also be used to measure the noise levels in idle channels of a loaded system.

1.1.2.2. Measuring the cross-talk coupling loss

The high sensitivity of the instrument - the maximum sensitivity at full-scale deflection is -110 dB or -100 dBm, the minimum readable level -130 dB or -120 dBm - permits measurement of the cross-talk coupling loss to be easily carried out with level meter D2007.

1.1.2.3. Continuous supervision of a carrier frequency system

For this test function level meter D2007 is connected to the system, tuned to the signal to be measured, for instance one of the CCITT line pilots, and the AFC is cut in.

The locking range of the AFC incorporated in the D2007 is so large that a variation in the frequency of the test signal or the level meter itself within the typical range for the signal or the level meter does not cause the AFC to unlock and thereby interrupt the measurement.

A voltage or current recorder (250 mV or 100 A full-scale deflection, R_i = 2.5 kΩ) can be connected to the recorder output of the level meter for recording the measured values.

The measured values can also be recorded by connecting digital level meter D2010 to one of the two 100 kHz IF outputs of level meter D2007. A printer must be connected to the digital level meter for recording the measured values.

1.1.2.4. Measurements "on the route"

As a result of the light-weight but rugged 19 inch design and the possibility of operating the instrument from dc voltage sources (12 to 48 V), e.g. from power supply units or batteries, level meter D2007 is particularly suitable for equipping test trucks.

Battery power supply B2069 was developed for the D2007 and the W2007 for this application. It provides approximately 6 hours of continuous operation of the level meter.

1.1.2.5. Operation with spot frequencies

In test departments and during the maintenance of carrier frequency systems and other carrier frequency equipment, measurements always arise which require a series of continuously recurring frequencies to be set in succession at the level meter (and also at the level oscillator).

For these frequently recurring applications the spot frequency generator G2031 was developed as the control unit for level meter D2007 (and also for level oscillator W2007).

Any one of the up to 16 frequencies, e.g. one of the standardized frequencies of the CCITT line and test pilots is cut in by pressing a key or by remote control.

The frequency range of the G2031 corresponds to that of the level meter, i.e. from 6 kHz to 18.6 MHz.

Connections to the level meter are effected via two 75 Ω coaxial cables.

Control generator G2212 or another suitable synthesizer can also be used as the control unit for the D2007 in the same way as spot frequency generator G2031.

1.1.2.6. Measurement of frequency response using the differential level method

Level meter D2007 together with level oscillator W2007 forms a level measuring setup.

In the case of measurements with differing input and output frequencies, e.g. when testing modulators, the frequencies are set separately at each instrument.

If the level meter and the level oscillator are to operate at the same frequency, it is logical to set the frequency at one instrument only and to synchronize the other instrument from the first one.

In the case of level measuring setup D/W2007 the frequency is set at the level meter during synchronized operation.

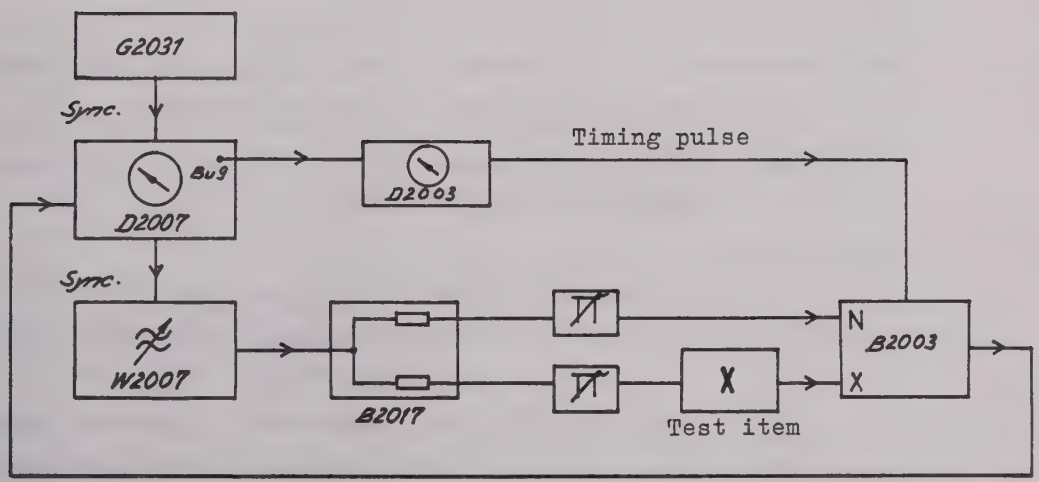
With synchronized operation the measurements with the selective level meter take on the character of wide-band measurements and the advantages of the selective level meter, such as elimination of interfering frequencies or the measurement of minimum levels, are fully retained.

The measurement described below is an example of the use of measuring setup D/W2007:

Measurement: The frequency response of an amplifier in the frequency range 6 kHz to 18.6 MHz, measurement with 16 spot frequencies.

Test equipment required:
1 level meter D2007
1 level oscillator W2007
1 spot frequency generator G2031
1 level difference meter G2003
1 branching unit B2017
1 N-X alternate-presentation switch B2003
2 variable attenuators (negligible frequency response)

Test setup:



The frequencies of the level meter and level oscillator are synchronized and controlled by spot frequency generator G2031 (the D2007 is synchronized by G2031, the W2007 by D2007).

The output signal of the W2007 is applied via the branching unit, the N arm (with a negligible frequency response) and the X arm (with the test item) to the N-X alternate-presentation switch, which is driven by the level difference meter in synchronism with the measuring equipment. Either the signal from the N arm or that from the X arm appears at the output of the N-X alternate-presentation switch. In level meter D2007 the output signal from the N-X alternate-presentation switch is translated to the 100 kHz range and is available at jack Bu9 for further measured value processing in the level difference meter. The difference between the amplitudes of the signals from the N arm and the X arm (test item) at the frequencies set by the spot frequency generator is then indicated on the level difference meter.

1.1.2.7. Frequency response measurement using the swept frequency method

Measurement of the frequency response (e.g. of an amplifier) using the swept frequency method has the advantage over the level difference method that the response curve is displayed on the screen of a level tracer and when photographed with an oscilloscope camera can be used for the test record.

The disadvantage of this method is the slightly lower measuring accuracy compared with the level difference method.

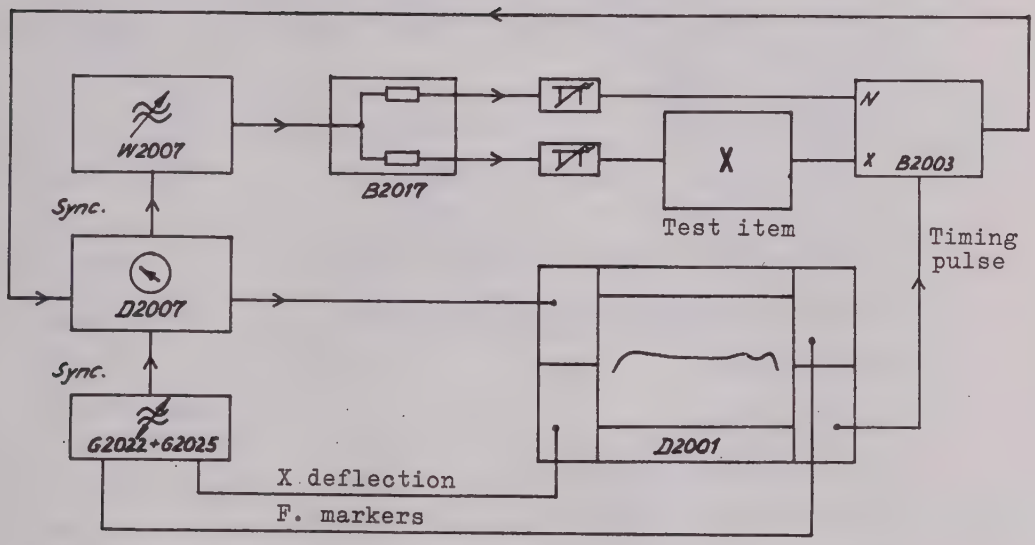
Measurement: Frequency response of an amplifier in the frequency range 6 kHz to 18.6 MHz.

Test equipment required:

1 level meter D2007
1 level oscillator W2007
1 sweep attachment G2022 with sweep oscillator G2025
1 level tracer D2001 with the 100 kHz IF plug-in D928 and frequency marker plug-in D928.

1 N-X alternate-presentation switch B2003
1 branching unit B2017
2 variable attenuators (negligible frequency response)

Test setup:



The measurement is performed in a way similar to that employed for the level difference method.

The test signal from the X and N arms, translated to the 100 kHz IF range in level meter D2007, is applied to the level tracer and indicated there.

The level tracer drives the N-X alternate-presentation switch.

1.1.2.8. Alignment of a band-pass filter using the swept frequency method

The measuring procedure described in the previous section offers particular advantages when applied to the alignment of band-pass filters and similar test items.

From the shape of the response curve displayed on the level tracer the individual circuits (e.g. of a multi-section LC band-pass

filter), can be aligned correctly in a very short time and the pass curve of the band-pass filter can be measured on the level tracer with the aid of the superimposed frequency markers and line levels.

1.2. Electrical specifications

Unless otherwise specified all data relate to the temperature range 0° to $+50^{\circ}C$.

Frequency range

coaxial input: 6 kHz to 18.6 MHz
balanced input: 6 kHz to 2.2 MHz
balanced 124 Ω input: 30 kHz to 10 MHz

Frequency setting with 2 film drives

set frequency $f = f_1 + f_2$

Coarse setting f_1

locked in 100 kHz steps: 0...18.6 MHz
or continuously variable: 0 to 18.6 MHz

Fine setting f_2

continuously variable: -10 to +110 kHz
spacing of graduations on scale: 500 Hz
minimum readable frequency difference: about 100 Hz

Frequency accuracy, f_1 locked, f_2 continuously variable, after 0 Hz calibration: $\pm 1.10^{-5} \pm 300$ Hz

Variation in frequency (f_1 locked, f_2 continuously variable) with supply voltage variations of ± 10%: $1.10^{-7} \pm 5$ Hz

Automatic tuning (synchronized)
Tuning of the level oscillator from the level meter for f_1 and f_2

Wide-band sweeping
with sweep attachment G2022 + plug-in G2025 for coarse setting of f_1:
Lower and upper cut-off frequency continuously variable between 6 kHz and 18.6 MHz

Sweep width: 200 kHz to 18.6 MHz

or

Center frequency continuously variable between
6 kHz and 18.6 MHz

Sweep width: ± 10 kHz to ± 1 MHz

Narrow-band sweeping
with sweep attachment G2022 + plug-in G2026 for the fine setting of f_2:

Center frequency continuously variable from f_2 = 0 to 100 kHz between the 100 kHz locking points of f_1, from 6 kHz to 18.6 MHz

Sweep width: ± 100 Hz to ± 50 kHz.

Automatic frequency control AFC:
50 kHz to 18.6 MHz, can be disabled.

Measuring range, for 0 dB indication on meter, settable in 10 dB steps:

coaxial input

6 kHz to 18.6 MHz: -110 to +10 dB (-100 to +20 dBm)

Smallest measurable level: -120 dB (-110 dBm)

Smallest readable level: -130 dB (-120 dBm)

balanced input:

6 kHz to 2.2 MHz: -100 to+20 dB (-90 to +20 dBm)

smallest measurable level: -110 dB (-100 dBm)

smallest readable level: -120 dB (-110 dBm)

balanced 124 Ω input:

30 kHz to 10 MHz: -100 to +20 dB (-90 to +20 dBm)

smallest measurable level: -110 dB (-100 dBm)

smallest readable level: -120 dB (-110 dBm)

Measuring accuracy,

Measuring range 0 dB (+10 dBm) 0 dB indication on meter at 1 MHz and Ri = Ra = 75 Ω

In the temperature range 15° to +35°: ± 0.1 dB

In the temperature range 0° to +50°: ± 0.2 dB

Attenuator accuracy at 1 MHz: ± 0.05 dB

Frequency response

Referred to 1 MHz and 0 dB meter indication

coaxial input, 6 kHz to 12 MHz: ± 0.1 dB
to 15 MHz: ± 0.2 dB
to 18.6 MHz: ± 0.3 dB

balanced input, 10 kHz to 1.6 MHz: ± 0.1 dB
6 kHz to 2.2 MHz: ± 0.2 dB
at Z = 124 Ω, 30 kHz to 10 MHz: ± 0.2 dB

Change in the indication for operating voltage variation of ± 10%: ± 0.02 dB

Mode of operation can be switched from "low distortion" to "low noise".

Expansion of indication, scale-spread device
Measuring range settable in steps of: 1 dB
smallest readable level difference with low noise mode of operation: 0.02 dB

Bandwidth

Settable to Bands:	Narrow	Wide	Wide
Pass band Δ a = 0.5 dB	$>\pm$ 20 Hz	$>\pm$ 500 Hz	$>\pm$ 1.6 kHz
Bandwidth Δ a = 3 dB	80 Hz	$\sim$ 1.74 kHz	$\sim$ 6 kHz
Stop-band attenuation			
Δ a >30 dB	-	-	$\pm$ 10 kHz
Δ a >60 dB	$\pm$ 500 Hz	-	$\pm$ 40 kHz
Δ a >80 dB	-	$\pm$ 2 kHz	-
Effective noise bandwidth		1.74 kHz	

Image-frequency rejection at f +48 MHz: >60 dB

Intrinsic harmonic ratio ak2 and ak3 with sensitivity increased by 50 dB: >70 dB

Overload indication for the measurement of harmonics and non-harmonics (50 dB and 70 dB increase in sensitivity.)

Deflection due to inherent noise with input terminated in Z and 1.74 kHz bandwidth: <-120 dB (-110 dBm).

Input impedance
coaxial, 6 kHz to 18.6 MHz: 10 kΩ//60 pF
settable to: 75 Ω
return loss: >34 dB
with probe B2015: 10 kΩ//10 pF
with probe B2015 and attenuator B2050: 100 kΩ//8 pF

balanced, 6 kHz to 2.2 MHz: high impedance
settable to : 124 (130), 135 (140), 150 Ω $\pm$ 1%
balanced: 30 kHz to 10 MHz: 124 Ω $\pm$ 2%

Input jacks

4/13 special, outer conductor grounded
can be modified to BNC; 1.5/5.6; 2.5/6; LEMO
three-contact jacks, ungrounded, balanced.

Outputs

IF output I, 100 kHz, across R_o = 600 Ω: max. 0 dB

Dynamic range for input level: about 100 dB

e.g. for logarithmic amplifier D 920

IF output II, 100 kHz

Output level for 0 dB indication on meter across Z = 75 Ω: 0 dB

e.g. for linear amplifier or digital level meter

Earphone output (single sideband output)

settable to: upper and lower sideband

output level with 0 dB indication on meter

about 0 dB across 600 Ω

Recorder output:

For connection of proprietary continuous-line recorder with 100 µA or 250 mV full-scale deflection and an impedance of 2500 Ω.

AC power connection, double-insulated: 100 to 132 and 200 to 264 V, 47 to 63 Hz, about 30 W at 220 V.

Battery connection: 12 to 48 V, about 25 W,

Grounding of positive or negative battery terminal permissible.

1.3. Mode of operation

1.3.1. General

Operation of level meter D2007 is based on the superheterodyne receiver principle with triple frequency conversion.

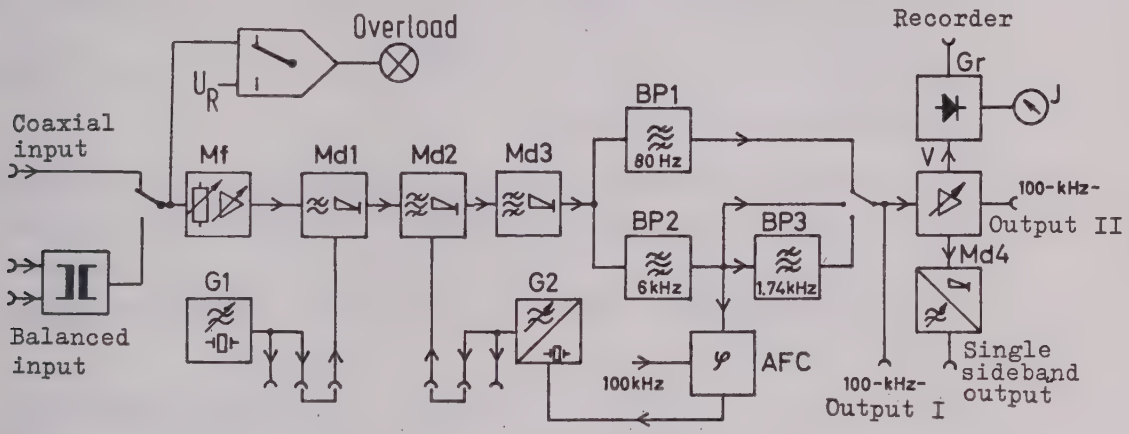


Fig. 2 General block diagram of level meter D2007

The input level is adapted on control panel Mf according to the measuring mode so as to obtain optimum measuring conditions. After triple frequency conversion in modulators Md1, 2 and 3, with the first intermediate frequency (ZF1) 24 MHz above the highest measured frequency 18.6 MHz, the test signal is in the 100 kHz IF range and is passed through band-pass filter BP1, 2 or 3 which provide the level meter selectivity. In accordance with the application an 80 Hz, 6 kHz or 1.7 kHz filter can be cut in. After the filters the main amplification of the level meter is effected in the preamplifier and final amplifier V to voltage levels which permit rectification in meter circuit Gr with maximum linearity and independence of temperature. The rectified quasi-rms evaluated voltage (important for noise measurements with the 1.74 kHz filter) is indicated either expanded or directly on a moving-coil meter. A continuous-line recorder or printer, e.g. for continuous supervision, can be operated from a dc voltage output parallel to the moving-coil meter.

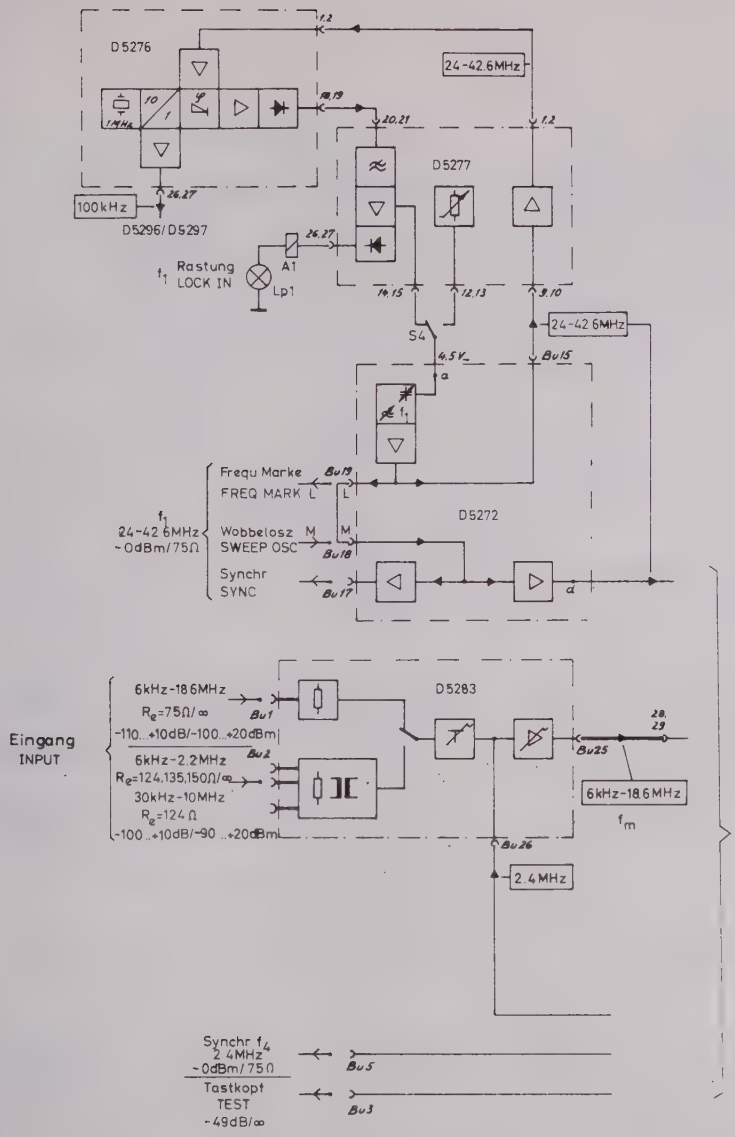
The measured signal is converted to the audio frequency range in a fourth modulator Md4.

By means of the AFC circuit the frequency of oscillator G2 is varied via a phase discriminator and a capacitance diode so as to tune the level meter to the measured signal.

For the overload indication the level present at the modulator input is compared with a reference voltage V_R. If the level is too high at the modulator input (overloading of the level meter) the lamp for the overload indication lights.

As a result of the high stability of the power supply for the level meter modules, variations in the supply voltage - 100 to 132 or 200 to 264 V for operation from an ac power line and 12 to 48 V for battery operation - have no effect on the measuring accuracy of the instrument.

Fig. 3 shows a complete block diagram of level meter D2007 which, together with the following descriptions of the individual modules, provides detailed information on the mode of operation of the instrument.



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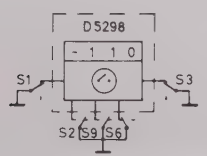
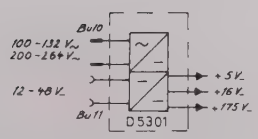




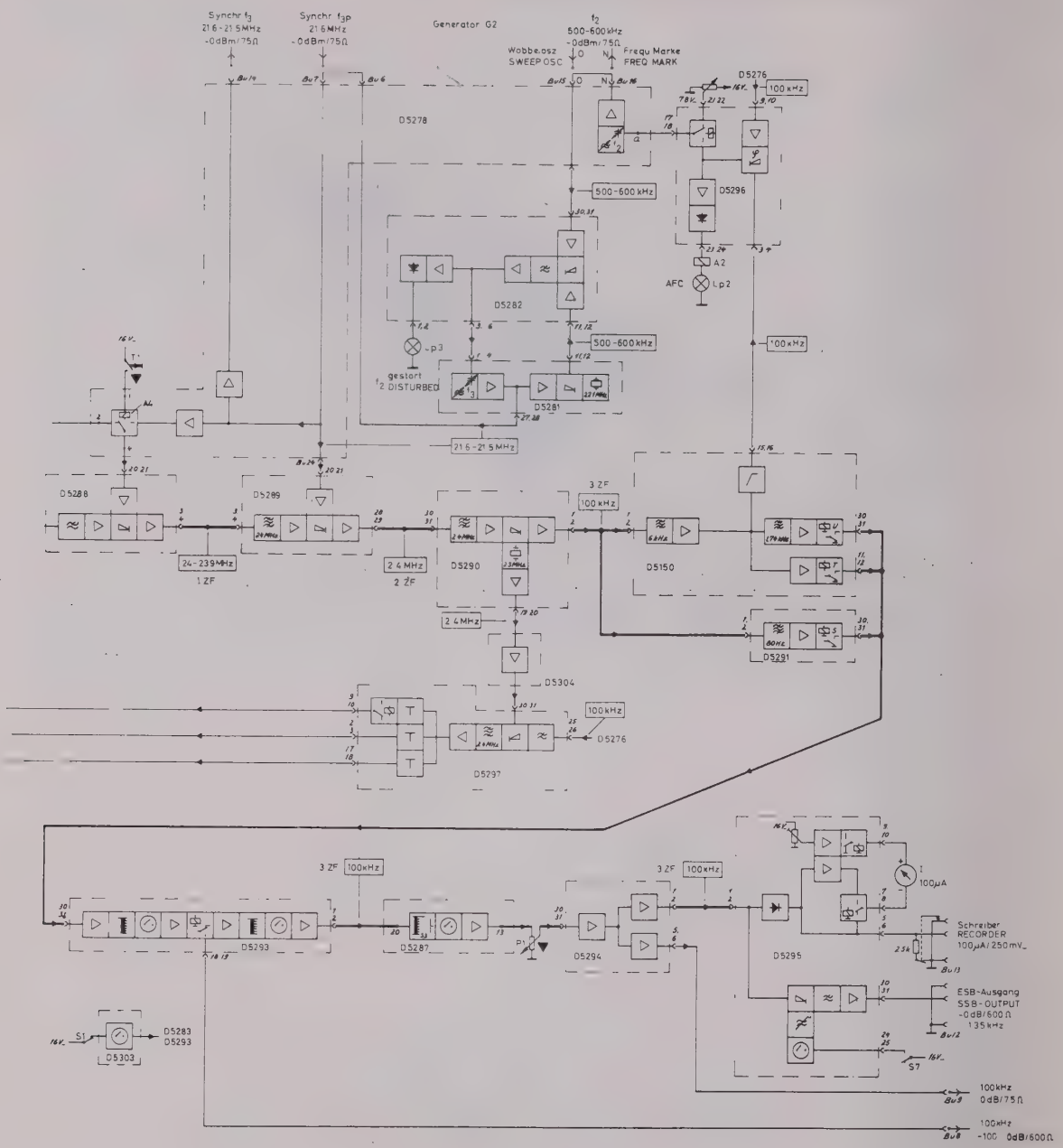


Fig. 3 Block diagram of level meter D2007

1.3.2. Oscillator G1

During normal operation of the level meter oscillator G1 supplies the conversion signal (at a frequency of 24 to 42.6 MHz and a level of 0 dB into 75 Ω) for conversion of the measured frequency to the first intermediate frequency of the D2007 and the voltage for the synchronization f_1 of level oscillator W2007.

This function is assumed by sweep oscillator G2025 during sweep operation, while oscillator G1 supplies the voltage for producing the frequency markers in sweep attachment G2022.

For calibration of the level meter the signal from oscillator G2 replaces that from oscillator G1 as the conversion signal for modulator 1.

The frequency is set with the aid of a film scale by variable capacitor C13 in the tuned circuit of oscillator f_1. This film scale is calibrated from 0 to 18.6 MHz, corresponding to the measured frequency converted in modulator M1 and is connected to the variable capacitor via gearing.

Two operation modes are possible for oscillator G1, i.e. free-running and locked operation.

Whereas with free-running operation any desired frequency can be set over the whole frequency band, with locked operation maximum frequency accuracy can be achieved every 100 kHz as a result of locking to the 100 kHz harmonics of a high stability quarz crystal.

In this case further frequency setting is carried out with oscillator f_2 between the 100 kHz steps.

Oscillator G1 consists of oscillator f_1, filter/amplifier and 1 MHz oscillator modules.

The circuit, mode of operation and interaction of these modules is described below.

1.3.2.1. f_1 oscillator -D5272

The f_1 oscillator is the principle component of oscillator G1.

This oscillator effects the frequency setting of oscillator G1, it supplies the conversion signal for converting the measured frequency to the first intermediatefrequency in modulator 1 and the voltage for synchronizing level oscillator W2007.

Oscillator f_1 consists of the modules oscillator 1 (D5274) and buffer amplifier f_1 (D5274).

The tuned circuit and the amplifier stage of oscillator f_1 are accommodated on the PC board "oscillator 1". The frequency of the output signal, 24 to 42.6 MHz, is set by means of variable capacitor C13, which is connected via gearing to the film scale f_1 and the knob for frequency setting. For temperature compensation the tuned circuit incorporates a special trimmer capacitor, TK trimmer capacitor C16, whose capacitance increases or decreases in proportion to the change in temperature, thereby maintaining a stable oscillator frequency over a wide temperature range. The capacitance diode Gr1, which is also in the tuned circuit, has a fixed capacitance due to a constant bias of +4.5 V during free-running operation of oscillator f_1, while in the case of locked operation its capacitance changes due to the change in the applied control voltage and thus adjusts the frequency of oscillator f_1 to the 100 kHz harmonic of the 1 MHz quarz crystal in the 1 MHz oscillator. For this locked operation the output signal is applied via a buffer amplifier in the module "filter/amplifier" to the 1 MHz oscillator and is the reference voltage for the 100 kHz harmonics of the 1 MHz quarz crystal.

The output signal from the oscillator is also applied to jack Bu 17

via the first section of the two-section f_1 buffer amplifier D5274 for synchronizing level oscillator W2007, and as the conversion signal to modulator 1 via the second section and relay A4 (on module D5275 in oscillator f_2).

1.3.2.2. Filter/amplifier -D5277-

This module consists of three functional units:

The "amplifier" (Ts5,6) operates as a buffer amplifier for the oscillator signal which is then compared with the crystal frequency in the 1 MHz oscillator.

The circuit "filter" incorporates the low-pass filter and the dc amplifier for the control voltage to the capacitance diode and the amplifier for indication of the locked condition of oscillator f_1.

The bias (+4.5 V) for the capacitance diode for free-running operation is obtained from the 14 V supply voltage via a zener diode and a potentiometer.

1.3.2.3. 1 MHz oscilllator -W5176-

An appropriate control voltage must be produced for the relevant capacitance diode Gr1 for accurately setting the frequency and stabilizing oscillator f_1. This takes place in a phase modulator (Ts5,6) as a result of comparison of the phase of the f_1 oscillator voltage (24 to 42.6 MHz) and the 100 kHz harmonics of the 1 MHz crystal frequency.

In the locked condition (i.e. n . 100 kHz) there is a fixed phase relationship between the reference voltage at the frequency f_1 and the control pulse (or the 100 kHz spectral line). The signal from the phase modulator contains only frequencies $\geq$100 kHz and voltage peaks of equal amplitude. The amplitude is dependent on the phase relationship between the f_1 reference voltage and the control pulse.

After amplification and rectification the voltage curve given on the module circuit diagram results, which contains only frequencies $\geq$100 kHz.

All ac voltages are attenuated in the low-pass filter of the subsequent filter/amplifier module, which has a cut-off frequency of 50 kHz. The remaining dc voltage is amplified and controls the capacitance diode in oscillator f_1. The amplitude of this dc voltage is likewise dependent on the phase relationship between the f_1 reference voltage and the control pulse. Irrespective of the position of the variable capacitor C13 (in oscillator f_1), the capacitance diode therefore receives a larger or smaller bias and adjusts the capacitance of the tuned circuit in oscillator f_1 so that the locked frequency n . 100 kHz always results.

In the free-running condition there is no fixed phase relationship in the phase modulator between the f_1 reference voltage and the control pulse, i.e. the sine of the reference voltage is sampled at various positions. The voltage from the phase modulator therefore varies in amplitude and as a result contains frequencies $\geq$100 kHz besides those $\leq$100 kHz. After amplification and rectification in the 1 MHz oscillator all voltages at f $\leq$50 kHz pass through the low-pass filter in the "filter"module, are amplified and applied to the capacitance diode of oscillator f_1, causing it to be swept. Adjustment with variable capacitor C13 leads to the reference frequency assuming the value n . 100 kHz, so that a fixed phase relationship between the reference voltage and the control pulse results in the phase modulator and oscillator f_1 locks.

1.3.3. Oscillator G2

During normal measurements oscillator G2 supplies the conversion signal (at a frequency of 21.6 to 21.5 MHz and a level of 0 dBm into 75 Ω) for converting the first level meter IF (24 MHz) to the second intermediate frequency (2.4 MHz) and the voltage for synchronization f_3 of level oscillator W2007.

During calibration of the level meter the signal from oscillator G2 is also applied to modulator 1 as the conversion signal and in this case replaces the voltage from oscillator G1.

Oscillator G2 is the interpolation oscillator for setting the frequency between the 100 kHz locked steps of oscillator G1 and, accordingly, can be continuously varied over a range of 100 kHz.

As in the case of oscillator G1 the frequency is set with the aid of a film scale, which is connected to variable capacitor C1 in oscillator f_2 via gearing. This film scale is calibrated from 0 to 100 kHz.

In order to achieve a frequency accuracy equivalent to that of oscillator G1 (in the case of locked operation) the following control principle was employed.

A signal at the difference frequency 500 to 600 kHz is formed in a modulator from the voltage of a crystal oscillator having a frequency of 22.1 MHz and that of capacitance diode tuned oscillator f_3 with a frequency 21.6 to 21.5 MHz. This signal, the reference voltage, is compared in the phase modulator with the control voltage from oscillator f_2 (500 to 600 kHz, tuned by means of variable capacitor C1). The output signal from the phase modulator drives a search oscillator, which in turn supplies the control voltage for the capacitance diode in oscillator f_3.

The conversion signal for modulator 2 of the level meter supplied from oscillator f_3 is therefore always adjusted to the frequency corresponding to variable oscillator f_2. However, due to the comparison with a high stability crystal oscillator, the frequency accuracy is significantly increased compared with that of the variable oscillator f_2.

As previously mentioned, oscillator G2 consists of the modules oscillator f_2, oscillator f_3 and phase modulator/search oscillator.

The circuit and interaction of these modules is described below.

1.3.3.1. f_2 oscillator -D5278-

Fine tuning of the level meter is effected by means of oscillator f_2. The output frequency of oscillator f_2, lying between 500 and 600 kHz, is converted to the range 21.6 to 21.5 MHz with the aid of the phase modulator (D5282) and oscillator f_3 (D5281). This range corresponds to the frequency range between the 100 kHz locking points of oscillator f_1. For this reason the frequency scale is graduated from 0 to 100 kHz with an additional 10 kHz at each end of the scale.

Oscillator f_2 consists of the modules "oscillator 2" (D5279), "buffer amplifier f_3" (D5280) and "relay board" (D5275).

These modules do not form an electrical functional unit, they are only housed in the oscillator f_2 case.

The tuned circuit and the amplifier stage of oscillator f_2 are housed on the "oscillator 2" PC board. The frequency of the oscillator output signal, 500 to 600 kHz, is set by means of variable capacitor C1, which is connected via gearing to the film scale f_2 and the knob for frequency setting.

The capacitors incorporated in the oscillator tuned circuit are selected with regard to their temperature characteristics so that they keep the oscillator frequency stable over a wide temperature range.

Two capacitance diodes (Gr8,9) have been incorporated in the tuned circuit of oscillator f_2 for the correction of long-term frequency changes in oscillator f_2 and to enable the frequency of the level meter to be automatically adjusted AFC) over a wide range to allow for any possible changes in the frequency of the measured signal.

With the AFC disabled (switch S8) these capacitance diodes receive a fixed bias (+7.8 V). This bias can be slightly adjusted with potentiometer P3, which can be actuated from the front of the D2007, if it should be necessary to align the frequency of oscillator f_2 and the corresponding value on the f_2 frequency scale (0 Hz calibration).

With the AFC cut in, instead of the fixed bias the capacitance diodes receive a variable bias corresponding to the phase relationship between the measured signal converted to the 100 kHz IF range and the 100 kHz voltage derived from the 1 MHz oscillator. This causes the capacitance of the diodes to vary and consequently the frequency of oscillator f_2 also. The frequency of the level meter is thus adjusted to the frequency of the measured signal.

In the case of sweep operation oscillator f_2 is replaced by sweep oscillator 2 (G2026). In this case oscillator f_2 supplies the voltage (500 to 600 kHz, 0 dBm into 75 Ω) for generating the frequency markers in sweep attachment G2022.

1.3.3.2. f_3 oscillator -D5281-

In the modulator of this module the reference voltage (at a frequency 500 to 600 kHz) for the phase modulator D5282 is derived from the signal of the 22.1 MHz crystal oscillator and that of oscillator f_3 which can be tuned by means of a capacitance diode (Gr7) in the range 21.6 to 21.5 MHz.

The signal from oscillator f_3 is coupled out following transistor Ts5,

amplified and applied to modulator 2 as the conversion signal for converting the first (24 MHz) to the second intermediate frequency (2.4 MHz). At the same time it is applied via one branch of the f_3 buffer amplifier D5280 to jack Bu 14 for synchronization of the level oscillator.

During calibration of the level meter the signal from oscillator f_3 passes through the other branch of the f_3 buffer amplifier D5280 and is applied to modulator 1 as the conversion signal via relay A4 on the relay board D5275.

1.3.3.3. Phase modulator/search oscillator -D5282-

The phase modulator receives the control voltage (500 to 600 kHz) from oscillator f_2 and the reference voltage (also 500 to 600 kHz) from oscillator f_3.

As long as the frequencies of the control and reference voltages are different, the phase modulator produces a composite ac voltage which passes through the low-pass filter and initiates operation of the search oscillator. The output voltage of the oscillator sweeps oscillator f_3 via its capacitance diode.

If the reference and control frequencies become identical during sweeping, negative feedback is applied to the search oscillator, causing it to immediately stop oscillating. The magnitude of the dc voltage produced by the phase modulator in this case depends on the phase angle between the control and the reference voltages. The capacitance diode in oscillator f_3 is controlled by this voltage in such a way that its frequency changes by exactly the same amount as the control frequency.

As long as the search oscillator is oscillating, i.e. oscillator G2 is not synchronized and therefore not generating a defined frequency, the signal from the search oscillator is applied via C22 to diodes Gr3 and Gr4, rectified and turns on transistor Ts8. This causes

f_2 fault lamp Lp3 to light, indicating that oscillator G2 is not synchronized. As soon as the search oscillator ceases to oscillate, i.e. oscillator G2 is synchronized (and generates a defined frequency), lamp Lp3 goes out to indicate that oscillator G2 is operating correctly.

1.3.4. Control panel -D5283-

The control panel consists of the input stage for setting the impedances, the input attenuator and the preamplifier.

In the input stage the input impedance of the level meter is matched to the measurement. For the coaxial input it can be switched to Z = 75 Ω and high impedance, for the balanced input to Z = 124, 135, 150 Ω and high impedance. The individual impedances are connected via relays.

The measured signal is attenuated by 0, 20 or 40 dB in the following input divider, and amplified by 0, 10 or 20 dB in the subsequent preamplifier. The selection of the attenuation or amplification stages employed in each case depends on the mode of operation (low noise or low distortion) of the level meter. They are connected via diode matrix -D5303- with the aid of relays (as in the case of the impedances).

For calibrating the D2007 the signal from the calibrating oscillator is fed in preceding the preamplifier and connected by pressing the calibrate key. It therefore passes through all the amplification stages of the level meter.

From the output of the control panel the measured or calibration signal is applied to the first modulator via a coaxial cable.

1.3.5. Modulator 1 -D5288-

The module "modulator 1" consists of the low-pass filter, the

modulator, the conversion signal amplifier and the amplifier.

The measured signal (6 kHz to 18.6 MHz) from the control panel (D5283) first passes through the low-pass filter, which has a cut-off frequency of 18.6 MHz and accordingly attenuates all signals (spurious frequencies) with higher frequencies (higher than 18.6 MHz) by more than 60 dB. In the modulator the measured signal is converted to the first intermediate frequency (1st IF) by means of the conversion signal from oscillator G1 (24 to 42.6 MHz). The measured signal, which is then in the 24 MHz range (24 to 23.9 MHz) of the level meter, is amplified in the amplifier (Ts3, 4) and appears at the output of modulator 1 (at pins 3/4) for further conversion in modulator 2.

1.3.6. Modulator 2 -D5289-

The measured signal from modulator 1 converted to the first IF range (24 to 23.9 MHz) of the level meter first passes through the 24 MHz band-pass filter, which passes only the measured signal, i.e. the corresponding frequencies (24 to 23.9 MHz). In the modulator the measured signal is converted a second time by means of the conversion signal from oscillator G2 (21.6 to 21.5 MHz) to the fixed second intermediate frequency of the level meter, 2.4 MHz.

1.3.7. Modulator 3 -D5290-

The measured signal from modulator 2 converted to the second IF (2.4 MHz) passes through a further (2.4 MHz) band-pass filter in order to obtain maximum spurious frequency rejection. It is then converted in the modulator to the third and last intermediate frequency of level meter D2007, 100 kHz, by means of the signal from the 2.3 MHz crystal oscillator, accommodated on the same PC board. The signal then appears at the output of the module, pins 1/2 for further selection and amplification.

The signal from the 2.3 MHz oscillator is also applied to the

calibrating oscillator D5297 to generate the calibrating signal.

1.3.8. 100 kHz band-pass filters

The main selectivity of the level meter is provided at the 100 kHz IF by means of the three 100 kHz band-pass filters with 3 dB bandwidths of 80 Hz, 1.74 and 6 kHz. The band-pass filter required for the measurement is selected by means of switch S5, the band-pass filter itself is connected by a relay located at the output of each of the band-pass filters (controlled by S5).

1.3.8.1. 80 Hz crystal band-pass filter

This crystal band-pass filter consisting of three circuits has a 3 dB bandwidth of approximately 80 Hz, a 0.5 dB pass band of approximately 40 Hz and a stop-band attenuation of more than 60 dB at a spacing of $\pm$ 500 Hz from mid-band (100 kHz). The pass-band attenuation of this 80 Hz filter can be matched to that of the 6 kHz filter with potentiometer R11 (and transistor Ts2). The 80 Hz filter is connected by energizing relay S (via switch S5). In this condition the measured signal is applied to the input of the following 100 kHz preamplifier via relay S after passing through the band-pass filter.

This 80 Hz band-pass filter should be cut in for all standard level measurements.

1.3.8.2. 1.74 and 6 kHz filters -D5150-

This module consists of an LC band-pass filter with a 3 dB bandwidth of about 6 kHz and a mechanical band-pass filter with a bandwidth of about 1.74 kHz.

In the case of measurements using sweep operation, particularly in the case of sweeping with a relatively high sweep frequency, a good filter transient response is necessary. For this measurement the measured signal is applied to the input of the 100 kHz preamplifier via transistors Ts1 and 2 and relay T after passing through the 6 kHz LC filter.

The 1.74 kHz filter is cut in for normal level measurements and in particular for measurement of the noise level in idle channels of an otherwise loaded system.

This mechanical 1.74 kHz filter has an effective noise bandwidth of 1.74 kHz, a pass-band width (a = 0.5 dB) of about ± 500 Hz and a stop-band attenuation of at least 80 dB at a spacing of ± 2 kHz from mid-band (100 kHz).

When the 1.74 kHz filter is cut in the measured signal passes through the 6 kHz filter, which improves the far-off attenuation of the 1.74 kHz filter, and the mechanical 1.74 kHz filter and is then applied via transistor Ts3 and relay U to the input of the 100 kHz preamplifier. The pass-band attenuation of the 1.74 kHz filter is matched to that of the 6 kHz filter with potentiometer R9 (and transistor Ts1).

For generation of the f_2 control voltage when the AFC is cut in the measured signal, at the 100 kHz IF, is applied to the phase discriminator on the AFC PC board D5296 via the 6 kHz filter and transistors Ts1 and 4.

1.3.9. 100 kHz preamplifier -D5293-

After selection in the 100 kHz band-pass filters the measured signal is amplified in the 100 kHz amplifiers D5293 and D5294 to the level required for indication on the meter and the 100 kHz outputs.

A level correction corresponding to the various impedances of the D2007 is necessary for the dBm version of the meter. This correction is carried out with the aid of the inductive divider U1 and the switching transistors Ts2 to 5 in the dB/dBm attenuator of the preamplifier D5293. For the dB version transistor Ts1 disables the inductive divider.

After passing through the dB/dBm attenuator the measured signal at

the 100 kHz IF is available at jack Bu 8 for further processing or for indication on the digital level meter or level tracer (if the jack is connected via its contact and via the relay V controlled by this contact). The gain of the level meter from the input to jack Bu 8 is also set by the contact of this jack so that the input and output levels (across Z = 600 Ω) are identical (A=1). This 100 kHz output of the D2007 is the so-called "dynamic" output with a dynamic range of about 100 dB (-100 to 0 dB).

The level indication (digital and meter display) is cut out by the contact when a cable is connected to Bu8.

If the contact is not actuated, the measured signal is further amplified in the 100 kHz preamplifier, and then attenuated by up to 60 dB in three inductive dividers in accordance with the required sensitivity, the required signal-to-noise ratio or the mode of operation (low noise/low distortion).

1.3.10. 10 x 1 dB attenuator -D5287-

After the 100 kHz preamplifier the measured signal passes through the module "10 x 1 dB attenuator". With normal unexpanded level indication the signal is attenuated by 9 dB by the inductive divider in this module, whereas if the scale-spread device is connected it is attenuated by 0 to 9 dB according to the magnitude of the level to be measured. The attenuation stages are selected by switch S3.

After this module the level of the calibration or measured signal can be varied by about ± 1 dB with the calibrating potentiometer before it is further amplified in the following final amplifier.

1.3.11. 100 kHz final amplifier -D5294-

In the 100 kHz final amplifier the measured or calibration signal is amplified by about 63 dB to the level required for the meter indication and the 100 kHz linear output (0 dB across 75 Ω for full-scale deflection of the meter).

It is then applied to the input of the meter circuit with an amplitude of +9 dB.

1.3.12. Meter circuit board -D5295-

In the meter circuit a dc voltage proportional to the input signal is derived from the measured signal by means of diodes Gr1 to 3. This dc voltage is used for level indication on the 100 µA meter and for operating a recorder (100 µA, 250 mV) at jack Bu 13 of the level meter.

Whereas with normal unexpanded indication the meter directly indicates the rectified measured voltage, with expanded level indication (scale-spread device) a differential amplifier driven by the rectified measured voltage supplies the voltage for the meter indication.

In the case of measurements on carrier frequency systems the signal converted to the VF range can be monitored at the SSB output (Bu 12) of the D2007.

For this purpose the measured signal in the 100 kHz IF range is converted to a signal at a sideband frequency of 1.35 kHz by means of the 101.35 kHz or 98.65 kHz (upright or inverted speech channel) signal from the oscillator (Ts5, U1, C15 to 17) which is switched via transistor Ts6.

1.3.13. AFC and Overload board -D5296-

With the AFC cut in the frequency of the level meter is adjusted to the frequency of the measured signal over a certain range (about

3 kHz). The adjustment of the level meter frequency is effected by altering the frequency of oscillator G2. To this end the frequency of oscillator f_2 is varied by changing the voltage at the capacitance diodes Gr8/9. The IC amplifier and demodulator TBA120 in the AFC module supplies the control voltage for these capacitance diodes forming it from the measured signal at the 100 kHz IF and the 100 kHz signal from 1 MHz oscillator D5276.

With the AFC cut out the fixed bias for the capacitance diodes in oscillator f_2 (7.8 V), set by potentiometer P3, is fed via a relay in the AFC module to oscillator f_2.

Lamp Lp1 indicates coincidence of the measured signal and level meter frequencies. The control voltage for this lamp is derived from the voltage which the demodulator (IC1) also supplies for the control of the capacitance diodes (in oscillator f_2).

The level (after amplification and rectification) present at the input of the first modulator is compared with a reference voltage in 2 comparators. The threshold of the first comparator is set to about -50 dB (for the measurement of harmonic distortion with the sensitivity of the D2007 increased by 50 dB compared with the fundamental frequency and that of the second to about -70 dB (for measuring spurios radiation with the sensitivity of the D2007 increased by 70 dB). If these thresholds are exceeded, lamp Lp2 lights in the fist case and both lamps (Lp2 and Lp3) in the second. In order to obtain accurate measurements, if one or both lamps light, the sensitivity of the D2007 must be reduced until lamp Lp2 goes out during harmonic distortion measurements and Lp3 goes out during spurious radiation measurements.

1.3.14. Calibrating oscillator -D5297-

This module supplies the highly stable calibration signal, the calibration voltage for the probe and the synchronizing voltage f_4.

All these output voltages from the module have a frequency of 2.4 MHz and are formed from the voltage of the 2.3 MHz crystal oscillator in modulator 3 and the 100 kHz voltage from the 1 MHz oscillator in an IC modulator (J_1, MC1596-G).

1.3.15. Display logic -D5298- (and -D5299-)

The sensitivity set on the level meter is indicated by the digital indicator tubes of the display logic, as a function of the positions of the sensitivity switch S1, the Z switch S2, the scale-spread device switch S3, the measuring mode switch (low noise/low distortion) S5 and the dB/dBm changeover switch S9.

The linkage of the positions of the sensitivity switch and those of the Z and the dB/dBm switches is effected by means of a "4 bit adder" and further linkage with the scale-spread device switch via "NAND" and "Exclusive OR" gates.

To switch off all indicator tubes - when a digital level meter is connected to jack Bu 8 for instance - it is necessary to connect ground to pin 8 of the module 31 contact connector. This is effected by plugging a cable into jack Bu 8. The connection to ground is made by actuating a contact.

1.3.16. Interconnection board -D5300-

The electrical connections to the modules in the module housing are mainly effected by tracks on the interconnection board. This double-copper-clad PC board accommodates the receptacles into which the modules are plugged and the pins to which the cables to the other modules in the unit and to the input and output jacks of the unit are soldered.

Numbered test points (pins) are provided in the board for measurements during maintenance, troubleshooting and fault elimination.

1.3.17. Power supply -D5301-

The power supply delivers the 5 V supply for the integrated circuits of module D5276 and D5298, the 175 V supply for the digital indicator tubes (also in module D5298) and the 14 V supply for the other modules of the level meter and the externally connected probe.

The voltage source for these dc voltages is the blocking-

oscillator converter D5302 in the power supply, which draws its input voltage either from the power rectifier or an externally connected battery.

The main advantage of the blocking-oscillator converter is its high efficiency over an input voltage range of 12 to 48 V. The variation in its output voltages is limited to less than ± 2% by a circuit incorporated in the blocking-oscillator converter. This slight variation is further reduced to ± 50 mV for the 16 V supply voltage in an IC voltage regulator.

A further advantage of the blocking-oscillator converter is the electrical isolation of the input from the output. This enables the positive or negative terminal of the external battery to be grounded without any further changes in the circuit.

With operation from an ac power line a changeover on the primary side between the line voltage ranges 100 to 132 V and 200 to 264 V is necessary. The power fuse must be selected according to the range. A 630 mA fuse is required for a line voltage of 100 to 132 V and a 315 mA fuse for a voltage of 200 to 264 V.

Grounding is not necessary on the ac power side, as the instrument, or specifically the power supply, is double-insulated in accordance with VDE regulations (VDE 0411).

1.3.18. Level matrix -D5303-

The selection of the combination of attenuation and amplifier stages in the level meter modules required for each particular measurement, is effected with the aid of the level matrix, a diode matrix. The level matrix is controlled via the measuring mode and sensitivity switches.

1.3.19. 2.4 MHz buffer amplifier -D5304-

This buffer amplifier positioned between the 2.3 MHz oscillator (in modulator 3) and the calibrating oscillator prevents interference with the measured signal at the 100 kHz IF by the voltage (2.4 MHz) from the calibrating oscillator (crosstalk).

1.4. Accessories, dimensions and weights

Item	Order no.	Dimensions in mm	Approx. weight in kg
Level meter D2007			
-120 dB to +20 dB	S45034-D2007-B102	448x284x282	14
-110 dB to +20 dBm	S45034-D2007-B204	448x284x282	14
	S45034-D2007-C102	448x284x282	14
	S45034-D2007-C204	448x284x282	14
Accessories			
1 power cable	V45594-F4-A322	1600	0.3
1 battery cable	V45257-R3003	1600	0.3
Optional			
Coaxial cables 4/13, Z = 75 Ω	V42251-C226-D4	1000	0.3
Balanced cables with two 3 pin plugs	V42255-R15-A20	1000	0.3
Balanced cables with one 3 pin plug and three single plugs	V42255-R6-J20	1000	0.3
Probe B2015 with divider B2050	see separate data sheets		
Battery power supply B2069	see separate data sheets		
Sweep attachment G2022	see separate data sheets		
Level tracer D2001	see separate data sheets		

2. Operating instructions

2.1. Putting the level meter into service

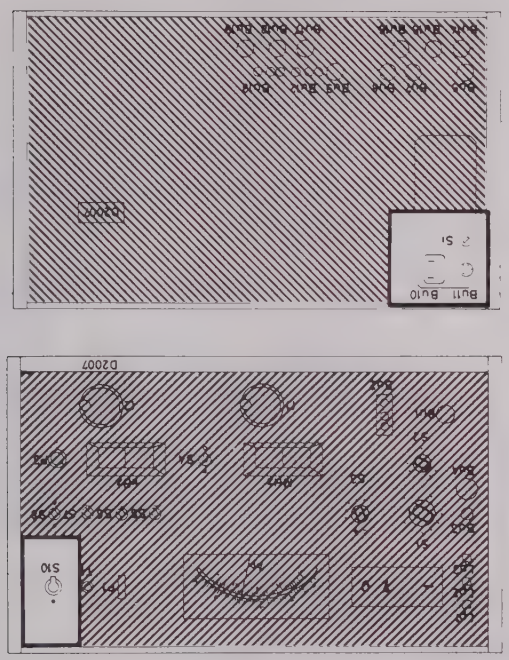


Fig. 4 Level meter D2007 with the controls for putting it into service

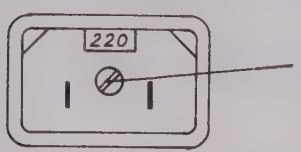


Fig. 5 Line voltage changeover

Switch "ON - OFF"	S10	For ac power and battery operation in position ⊙ in the ON condition.
Power connector	Bu10	Power connector, double-insulated; ac voltages 100 to 132 V, can be switched

		to 200 to 264 V; 47 to 63 Hz; approx. 25 VA; adjustment to line voltage by turning the screw in the power connector (Fig. 5).
Battery jack	Bu11	Battery jack, 5 contact; dc voltages 12 to 48 V with no changeover; approx. 23 W; battery can be grounded at "+" or "-" terminal as required.
Fuse	Si	Line voltage fuse, double-insulated; for line voltages of 100 to 132 V; 630 mA fuse, for line voltages of 200 to 264 V: 315 mA fuse.

Level meter D2007 can be operated from ac power sources with voltages of 100 to 132 V or 200 to 264 V and from batteries with voltages of 12 to 48 V.

2.1.1. AC power operation

Unless otherwise specified the instrument is set for operation in the ac line voltage range 200 to 264 V when supplied. For voltages in the range 100 to 132 V the line voltage selector should be switched to the correct range and the fuse changed (100 to 132 V/630 mA fuse, 200 to 264 V/315 mA fuse). Replacement fuses together with replacement lamps are supplied in a bag with the level meter.

Connection to the ac power is established by means of the cable provided. Grounding on the ac power side is not necessary as the unit is double-insulated in accordance with VDE regulations (VDE 0411).

The instrument is switched on by setting switch S10 to the position ⊙

2.1.2. Battery operation

If no ac power is available, e.g. for measurements on the route, the level meter can be operated from dc sources with voltages of 12 to 48 V. It is not necessary to switch the instrument to the voltage which is available.

Connection of the dc source is effected via the battery cable supplied. The battery connection in the level meter is ungrounded. Terminal 1 of the 5-contact jack is connected to "-" (negative), terminal 2 to "+" (positive). The level meter is protected against incorrect polarity by a diode.

A battery which is simultaneously connected during ac power operation is not charged.

The unit is switched on as in the case of ac power by setting switch S10 to position ⊙.

2.2. Setting the frequency - synchronization - sweep operation

2.2.1. Setting the level meter frequency

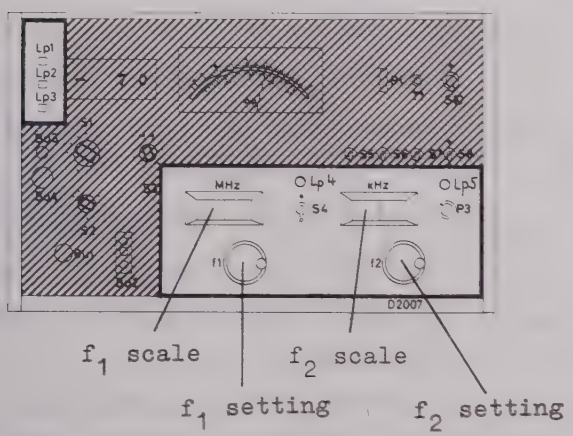


Fig. 6 Level meter controls for setting the frequency

f_1 scale	MHz	Main scale f_1, frequency indication from 0 to 18.6 MHz, spacing of graduations 100 kHz.
f_1 control		Setting the frequency f_1 with crank (coarse) and knob (fine) from 0 to 18.6 MHz.
Lock-in switch	S4	Switch for selecting the mode of operation of oscillator f_1: locked to crystal at 100 kHz intervals or free-running; locked: position ⊙ ; observe lamp Lp1.
Lock-in lamp	Lp4	Lamp for indicating the locked condition of oscillator f_1. Lamp lights: oscillator f_1 is locked.
f_2 scale	kHz	Fine scale f_2, frequent indication from -10 to +110 kHz, spacing of graduations 500 Hz.
f_2 control		Setting the frequency f_2 with crank (coarse) and knob (fine) from -10 to +110 kHz.
f_2 fault indication	Lp5	Lamp indication on failure of the internal synchronization of oscillator G2.
0 Hz calibration	P3	Potentiometer for setting the frequency at the 0 Hz calibration.
Upper-lower sideband	S7	Switch for selecting the upper or lower sideband at jack Bu12 (upright or inverted sideband at the input of D2007)
AFC switch	S8	In the ON condition, S8 in position ⊙ , level meter is adjusted to the frequency

of the measured signal.

In the OFF condition, S8 in position ○ , tuning aid for finding the maximum level indication.

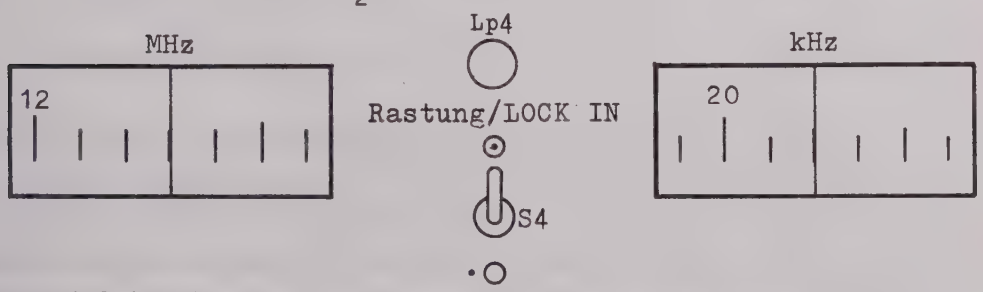
AFC indication Lp1 Lamp lights to indicate the condition "AFC locked", when S8 is in position ⊙ .

When S8 is in position ○ , the lamp lights when the level meter is tuned to maximum.

2.2.1.1. Setting f_1 and f_2

The frequency of level meter D2007 is set on two oscillators, oscillators f_1 and f_2. While oscillator f_1 covers the whole frequency range from 0 to 18.6 MHz, continuously or locked to a crystal at 100 kHz intervals, oscillator f_2 covers the range between the 100 kHz steps of oscillator f_1.

To set a certain frequency, e.g. 12.321 MHz,
oscillator f_1 is set to the locked position 12.3 MHz,
and oscillator f_2 to 21 kHz.



Crystal locking can be selected by means of switch S4 between the f_1 and the f_2 scales. Electronic locking commences near the associated scale division on the f_1 scale during frequency setting and is indicated by the lighting of f_1 lock-in lamp Lp4. However, to avoid reading errors the scale should always be set accurately to the scale division.

To seek a test signal it is advisable to tune the free-running oscillator f_1 with the 6 kHz bandwidth cut in, the AFC disabled and the sensitivity of the level meter set to a suitable level, until maximum deflection is observed on the meter (simultaneous lighting of the AFC lamp). Only after this presetting should oscillator f_1 be locked at the next lower scale division of the f_1 scale, the 1.74 kHz or the 80 Hz filter cut in, and the level meter tuned to the measured signal with oscillator f_2.

2.2.1.2. Automatic frequency control

After tuning to the measured signal the frequency of the level meter can, if required, be made to follow the frequency of the measured signal (e.g. for continuous supervision) over a wide range (approx. $\pm$ 2 kHz) by cutting in the AFC. The AFC lamp Lp1 lights to indicate that the frequency of the measured signal is identical to that of the level meter.

With the AFC cut in and locked the measuring accuracy of the level meter is increased, since measurement always takes place at the same point on the pass-band curve of the D2007 filter.

2.2.1.3. Failure of the control in oscillator G2

If the synchronization in oscillator G2 should fail, as a result of a component fault for instance, this is indicated by the lighting of lamp Lp5. The frequency set on the level meter no longer coincides with the measured frequency, and the frequency control loop of oscillator G2 should be checked in accordance with the "troubleshooting-fault elimination" section.

2.2.1.4. 0 Hz calibration

For 0 Hz calibration, a correction of the f_2 scale, the sensitivity of the level meter is set to 0 dB or +10 dBm/low noise, oscillator

f_1 to "0 MHz locked" with the 80 Hz filter cut in and the AFC cut out, and the f_2 scale to exactly "0 kHz". Potentiometer P3 is then adjusted so that the meter pointer deflection is maximum and the AFC lamp Lp1 lights.

2.2.2. Synchronization of the level meter and level oscillator W2007

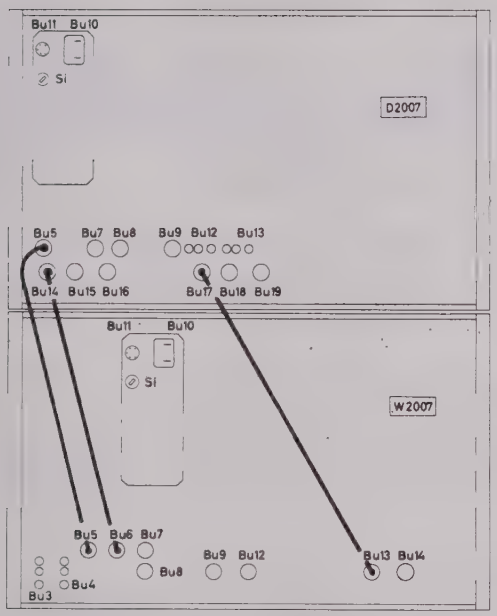


Fig. 7 Synchronization of the level oscillator from the level meter

Synchronization f_1	Bu17	Output jack for the synchronizing voltage f_1 (0 dBm in 75 Ω, 24 to 42.6 MHz) for synchronizing level oscillator W2007 (Bu13).
Synchronization f_3	Bu14	Output jack for the synchronizing voltage f_3 (0 dBm in 75 Ω, 21.6 to 21.5 MHz) for synchronizing level oscillator W2007 (Bu6).

Synchronization f_4	Bu5	Output jack for the synchronizing voltage f_4 (2.4 MHz) for synchonizing level oscillator W2007 (Bu5).

Level meter D2007 together with level oscillator W2007 forms a level measuring setup oovering the frequency range 6 kHz to 18.6 MHz.

For measurements in which the level meter and level oscillator operate in frequency synchronism, i.e. with the same output and input frequencies, it is advantageous to synchronize the level oscillator from the level meter. The level meter oscillators then replace those of the level oscillator.

With "synchronization f_1" oscillator f_1 of the level oscillator is replaced by that of the level meter, at which the frequency is also set.

The synchronizing voltages of the level meter at the frequencies f_3 and f_4 replace the voltages of the oscillators f_3 and f_2 of the level oscillator. The frequency is set at oscillator f_2 of the level meter.

Under normal conditions the level meter should supply the level oscillator with all three synchronizing voltages, i.e. f_1, f_3 and f_4. However if it appears practical for the measurement, either oscillator f_1 alone (synchronization f_1) or oscillators f_3 and f_2 (synchronization f_3 and f_4, but always these two together) can be replaced in the level oscillator by the relevant oscillators in the level meter.

2.2.3. Synchronization of the level meter from spot frequency generator G2031

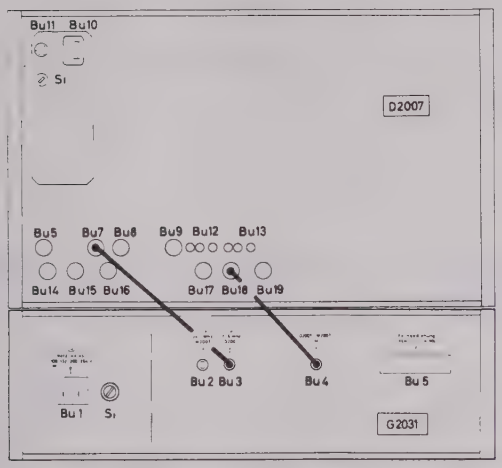


Fig. 8 Synchronization of the level meter from spot frequency generator G2031

Synchronization f_1	Bu18 M	Input jack for the synchronizing voltage f_1 (0 dBm in 75 Ω, 24 to 42.6 MHz) for synchronizing the level meter from spot frequency generator G2031 (Bu4).
Synchronization f_{3P}	Bu7	Input jack for the synchronizing voltage f_{3P} (0 dBm in 75 Ω, 21.6 MHz) for synchronizing the level meter from spot frequency generator G2031 (Bu3).

Spot frequency generator G2031 was developed as a supplementary unit for the frequency control of the level meter and the level oscillator in order to be able to use level meter D2007 and level oscillator W2007 for carrying out measurements with continuously repeated frequencies accurately, rapidly and economically.

When synchronizing the level meter from spot frequency generator G2031, oscillator f_1 in the level meter is replaced by the oscillator f_1 cut in in the G2031 and oscillators f_2 and f_3 in the D2007 are replaced by oscillator f_{2M} in the G2031.

The frequency accuracy of the level meter then corresponds to that of the spot frequency generator.

Measurement with AFC is not possible.

2.2.4. Synchronization of the level meter from control generator G2212

By connecting a programmable synthesizer, for instance, it is possible to use level meter D2007 to carry out measurements with a programmed frequency variation. Control generator G2212 is connected to the level meter in the same way as spot frequency generator G2031. Jack Bu18-M is again the input jack for the variable f_1 signal (0 dBm in 75 Ω, 24.006 to 42.6 MHz, corresponding to the frequency of the measured signal, 6 kHz to 18.6 MHz) and jack Bu7 the input jack for the f_{3P} signal (0 dBm in 75 Ω, 21.6 MHz).

2.2.5. Sweep operation of the level meter - large sweep width

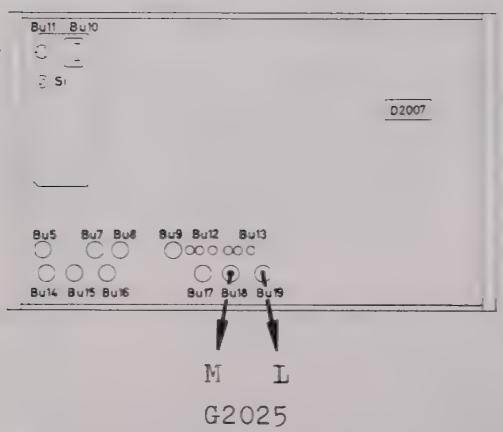


Fig. 9 Connection of the level meter to sweep oscillator G2025 in sweep attachment G2022.

Sweep oscillator f_1	Bu18 M	Input jack for the synchronizing voltage f_1 (0 dBm in 75 Ω, 24 to 42.6 MHz) for synchronizing the level meter from sweep oscillator 1 (G2025).
Frequency marker f_1	Bu19 L	Output jack for the oscillator voltage f_1 (0 dBm in 75 Ω, 24 to 42.6 MHz) for forming the frequency marker in the G2022 + G2025.

For some measurements it is necessary to be able to continuously vary the frequency of the level meter with automatic frequency sweeping.

If the frequency is to be automatically varied over sections of the level meter requency band which are wider than 100 kHz, or automatically varied over the whole frequency band from 0 to 18.6 MHz, this can be achieved by connecting sweep attachment G2022 (with sweep oscillator 1, G2025) to the level meter.

Sweep oscillator 1 (G2025) then replaces the internal oscillator f_1 of the D2007, while this internal oscillator f_1 supplies the voltage for generating the frequency markers in the sweep attachment.

2.2.6. Sweep operation of the level meter - small sweep width

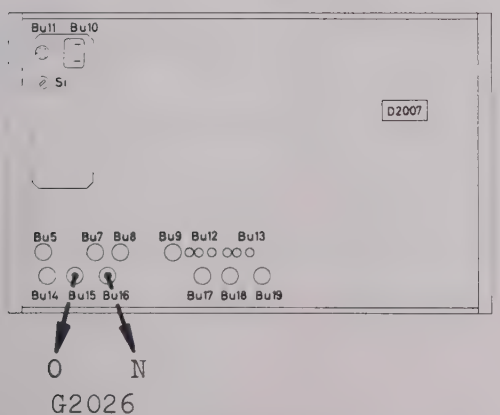


Fig. 10 Connection of the level meter to sweep oscillator G2026 in sweep attachment G2022

Sweep oscillator f_2	Bu15 0	Input jack for the synchronizing voltage f_2 (0 dBm in 75 Ω, 500 to 600 kHz) for synchronizing the level meter from sweep oscillator 2 (G2026).
Frequency marker f_2	Bu16 N	Output jack for the oscillator voltage f_2 (0 dBm in 75 Ω, 500 to 600 kHz) for forming the frequency markers in the G2022 + G2026).

For some measurements it is useful to be able to continuously vary the frequency of the level meter with automatic frequency sweeping over a range which is less than 100 kHz. This can be achieved by connecting the level meter to sweep attachment G2022 (with sweep oscillator 2, G2026).

In this case sweep oscillator 2 (G2026) replaces the internal oscillator f_2 of the D2007, while this internal oscillator f_2 supplies the voltage for generating the frequency markers in the sweep attachment.

2.2.7. Frequency control of the synchronized test setup

If the frequency sweep of the synchronized test setup D/W2007 is to be controlled by spot frequency generator G2031, a synthesizer (e.g. control generator G2212) or sweep attachment G2022 (with sweep oscillator 1 or 2), the level meter and the level oscillator should be interconnected per 2.2.2., and then the spot frequency generator G2031 should be connected per 2.2.3., the control generator per 2.2.4. or the sweep attachment per 2.2.5. or 2.2.6. to level meter D2007.

2.3. Calibration of the level meter

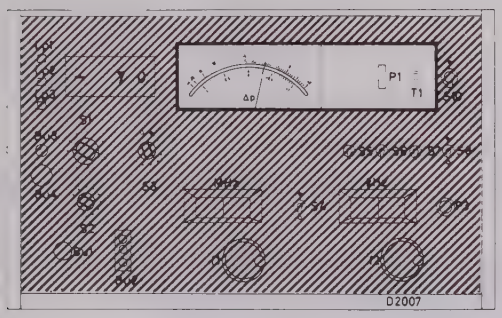


Fig. 11 Level meter with the calibration controls

Meter	I	Indication of the measured value (added to the value on the digital display); Upper scale: scale-spread device cut out, Lower scale: scale-spread device cut in. Mechanical zero set by means of the screw below the meter.
Calibration potentiometer	P1	Control for calibration of the level meter (with and without probe); with calibration key T1 depressed set meter pointer to red calibration triangle (upper scale: scale-spread device cut out; lower scale: scale-spread device cut in).
Calibration key	T1	Key for setting the gain and frequency required for calibration.

All level meter settings necessary for the calibration process are made when calibration key T1 is pressed. While the key is pressed, the meter pointer can be set by calibration potentiometer

P1 to the red calibration triangle on the scale (with the scale-spread device cut out to the calibration triangle on the upper scale, and with the scale-spread device cut in to the triangle on the lower scale) and the level meter so calibrated.

2.4. Setting the input impedance of the level meter

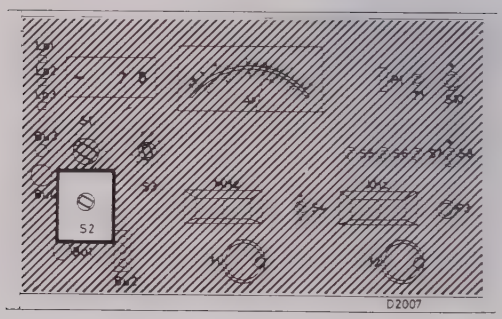


Fig. 12 Level meter D2007 with the switch for setting the input impedance

Z switch	S2	Switch for selecting the input impedance of the level meter: 75 Ω and high impedance (unbalanced, 6 kHz to 18.6 MHz); 124 (130), 135 (140), 150 Ω and high impedance (balanced, 6 kHz to 2.2 MHz). 124 Ω (balanced, 30 kHz to 10 MHz).

If required the input impedance of the level meter can easily be modified to the values specified in brackets for the balanced range 6 kHz to 2.2 MHz.

2.5. Setting the sensitivity of the level meter

(Measuring range, measuring mode, scale-spread device, bandwidth)

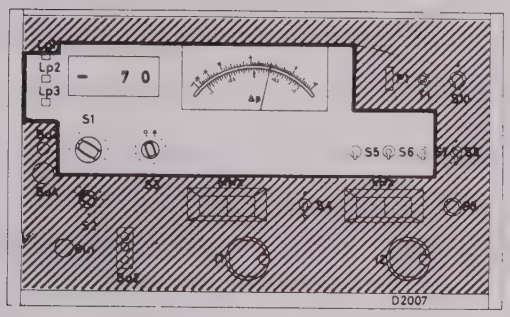


Fig. 13 Controls for setting the sensitivity of the level meter

Level indication		Digital display for indicating the sensitivity set on the level meter.
Meter	I	Indication of the measured value (added to the value on the digital display); Upper scale: scale-spread device cut out. Lower scale: scale-spread device cut in. Mechanical zero set by means of the screw below the meter.
Level switch	S1	Switch for setting the level meter sensitivity; setting in steps of 10 dB in the range -110 to +10 dB or -100 to +20 dBm.
Scale-spread device	S3	Switch for cutting in the expanded level indication (scale-spread device) and for fine setting of the level

		meter sensitivity: Setting in 10 steps of 1 dB for low-noise operation.
Bandwidth	S5	Switch for selecting the selectivity of the level meter: 3 dB bandwidth 80 Hz, 174 kHz or 6 kHz.
Low-noise - low distortion	S6	Switch for selecting the measuring mode: low noise or low distortion.
Overload indication	Lp 2	Lamp for indicating overload of the level meter when measuring harmonics (harmonic distortion)
Overload indication	Lp 3	Lamp for indicating overload of the level meter when measuring non-harmonics (spurious radiation).

2.5.1 Sensitivity: setting - indication

The sensitivity set on the level meter is indicated on the digital display to the left of the meter as a function of the positions of the level, the impedance, the "scale-spread device" and the measuring mode switches.

After calibration has been carried out and the frequency and impedance have been set on the level meter the value of the measured signal can be read from the digital display and the meter. In the case of measurements for which the scale-spread device is not cut in the upper meter scale is used and the lower scale for measurements with the scale-spread device cut in.

Example (values in dB)

Digital display	+	meter indication	=	measured value
(-30)	+	(-4.0)	=	-34.0
(-30)	+	(+0.4)	=	-29.6
(+ 8)	+	(-0.2)	=	+ 7.8

2.5.2. Scale-spread device

For very accorate measurements in the "low-noise" mode, it is

desirable to have an indication with maximum possible resolution. In order to achieve this each measured value in the range -10 to 0 dB on the upper meter scale of level meter D2007 can be transferred to the range 0 to ± 1 dB on the lower scale with the aid of the scale-spread switch.

The measured value again consists of the digital display and the meter indication.

2.5.3. Measuring mode: low noise - low distortion

Before each measurement consideration should be given to which setting of the level meter will give the best result and which measuring mode (low noise or low distortion) and bandwidth (80 Hz, 1.74 or 6 kHz) are preferable for this particular measurement.

For all normal level measurements in the range -90 to +10 dB or -80 to +20 dBm, with and without the scale-spread device, one special feature of the level meter, i.e. its low inherent noise, is used by selecting the measuring mode "low noise".

If, on the other hand, harmonic ratio measurements are to be made, it is necessary for the inherent harmonic ratio of the level meter to be as large as possible. This is the case with the D2007 when the measuring mode switch S6 is set to the position "low distortion". If, for example, the attenuation of the second harmonic of a signal compared with the level of the fundamental frequency is to be measured, the measuring mode switch is set to the position "low distortion" and the level of the fundamental frequency is measured. The level meter is then tuned to the harmonic, the sensitivity of the level meter increased by a maximum of 50 dB with level switch S1 and the level of the harmonic measured.

For very accurate measurements in the "low-noise" mode, it is desirable to have an indication with maximum possible resolution.

During this procedure the overload indication (lamp Lp2) should not light. If the lamp lights, this is a sign that the level meter is overloaded and the measurement is therefore incorrect. In this case the sinsitivity of the level meter must be reduced until Lamp Lp 2 goes out.

For the measurement of spurious radiation the sensitivity of the level meter should be increased by a maximum of 70 dB.

During this procedure lamp Lp2 may light but lamp Lp3 may not. If it does, this is a sign that the level meter is overloaded and that the measurement is therefore incorrect. In this case likewise the sensitivity of the level meter must be reduced until lamp Lp3 goes out.

2.5.4. Bandwidth

The setting of the level meter selectivity (bandwidth) likewise depends on the particular measurement.

If there is a probability of another signal being present near the signal to be measured, e.g. at a spacing of 200 Hz, this measurement can only be carried out with the 80 Hz filter cut in.

If no other signal is expected near the measured signal, measurements can be carried out with the 1.74 kHz filter. A special application for this filter, which has an effective noise bandwidth of 1.74 kHz and a stop-band attenuation greater than 80 dB at a spacing of $\pm$ 2 kHz from the filter center frequency, is the measurement of noise levels in the idle channels of an otherwise loaded system.

The 6 kHz wide filter is provided for swept frequency measurements.

Connection to the test item is effected via the appropriate coaxial or balanced cables.

2.7. Level meter output jacks

(100 kHz outputs, headphone output, recorder output)

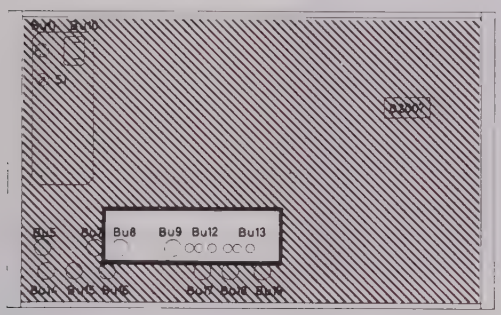


Fig. 15 Level meter with the 100 kHz IF outputs, the headphone output and the recorder output

Dynamic output	Bu8	100 kHz IF output; coaxial jack 1.6/5.6, outer conductor grounded; output level across Z = 600 Ω proportional to the input level of the level meter in the range from about -100 to 0 dB (dBm). When a cable is connected to jack Bu8, the digital display and meter indication are cut out.
Linear output	Bu9	100 kHz IF output; coaxial jack 1.6/5.6, outer conductor grounded; output level across Z = 75 Ω proportional to the meter indication.
Headphone output	Bu12	3-contact jack (b and c wires grounded)

Connection to the test item is effected via the appropriate coaxial or balanced cables.

2.7. Level meter output jacks

(100 kHz outputs, headphone output, recorder output)

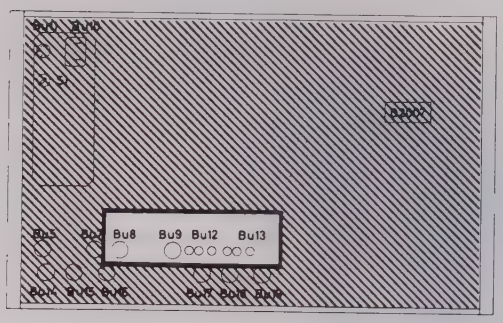


Fig. 15 Level meter with the 100 kHz IF outputs, the headphone output and the recorder output

Dynamic output	Bu8	100 kHz IF output; coaxial jack 1.6/5.6, outer conductor grounded; output level across Z = 600 Ω proportional to the input level of the level meter in the range from about -100 to 0 dB (dBm) for coaxial operation. When a cable is connected to jack Bu8, the digital display and meter indication are cut out. Lamps Lp2 and Lp3 may light up for this operation.
Linear output	Bu9	100 kHz IF output; coaxial jack 1.6/5.6, outer conductor grounded; output level across Z = 75 Ω proportional to the meter indication.
Headphone output	Bu12	3-contact jack (b and c wires grounded)

		for connection of a headset; approx. 0 dB across 600 Ω, 1.35 kHz for the upper and lower sidebands (upright and inverted sidebands) depending on the position of switch S7.
Recorder output	Bu13	3-contact jack (b and c wires grounded) for connection of a recorder (100 µA or 250 mV full-scale deflection) for continuous monitoring.

2.7.1. Dynamic output

This 100 kHz IF output can be used, for example, for the connection of a level tracer or digital level meter for additional measured value processing or indication.

When a cable is plugged into this output jack (with contact) the gain of the level meter is so set that the output level at jack Bu8 is the same as the input level to the level meter.

Example:

Input level ..... -20 dB across Z = optimal
Output level at Bu8 ..... -20 dB across Z = 600 Ω

When a cable is connected to Bu8 the digital display and meter indication are cut out.

For this application the input level to the D2007 should not exceed the value 0 dB or 0 dBm.

The two lamps Lp2 and Lp3 (overload indication) may light up in accordnace with the possible high input level. In this case there is now measurement error.

2.7.2. Linear output

This 100 kHz IF output can also be used for the connection of a level tracer or digital level meter for additional measured value processing or indication.

The level present at jack Bu9 (across Z = 75 Ω) corresponds to the level indicated on the meter of the instrument.

2.7.3. Headphone output

A headset or oscilloscope can be connected to this output jack for monitoring the speech channel. Matching to the transmission position (upright or inverted) is effected by means of switch S7 on the front of the instrument. By means of this switch either the upper or the lower sideband of the speech channel can be cut in as required.

2.7.4. Recorder output

A voltage or current recorder (250 mV or 100μA full-scale deflection) can be operated from this dc output of the level meter for measured value recording e.g. for the continuous monitoring of a carrier frequency system.

A voltage of 200 mV or a current of 80.0μA at the recorder jack corresponds to a meter indication of 0 dB.

2.8. Probe connection - calibrating the probe

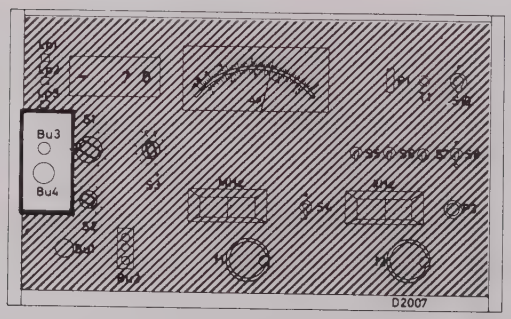


Fig. 16 Level meter D2007 with jacks for connecting the probe

Calibration jack	Bu3	Output jack for the 2.4 MHz calibration signal for calibration of the probe.
Probe power	Bu4	5-contact jack for the probe power,

Terminal 1: ground
Terminal 2: +14 V

Probe B2015 (1:1, R_{in} >10 kΩ//10 pF) or probe B2015 with attenuator B2050 (a = 30 dB, R_{in} 100 kΩ) is available for use in conjunction with level meter D2007 for measurements which have to be made at high impedance directly at the test item (and for which the result must not be invalidated by the coaxial cable between the test item and the input to the instrument).

2.8.1. Calibrating the probe

For calibration of probe B2015 with the level meter the probe input is connected to jack Bu3, the probe output to coaxial input jack Bu1 and the 5-contact probe plug to the 5-contact power jack Bu4 of the level meter. The Z switch S2 must be set to the position "75 Ω/coaxial".

With calibration key T1 pressed the probe can be calibrated in conjunction with the level meter. By means of calibration potentiometer P1 the meter pointer of the D2007 is set to the red calibration triangle on the scale (upper scale - scale-spread device not cut in, lower scale - scale-spread device cut in).

2.8.2. Measurement with the probe

For measurements the probe remains connected to jacks Bu1 and Bu3 of the level meter, and the Z switch of the D2007 remains in the position "75 Ω/coaxial". All other settings are made as for measurements without the probe.

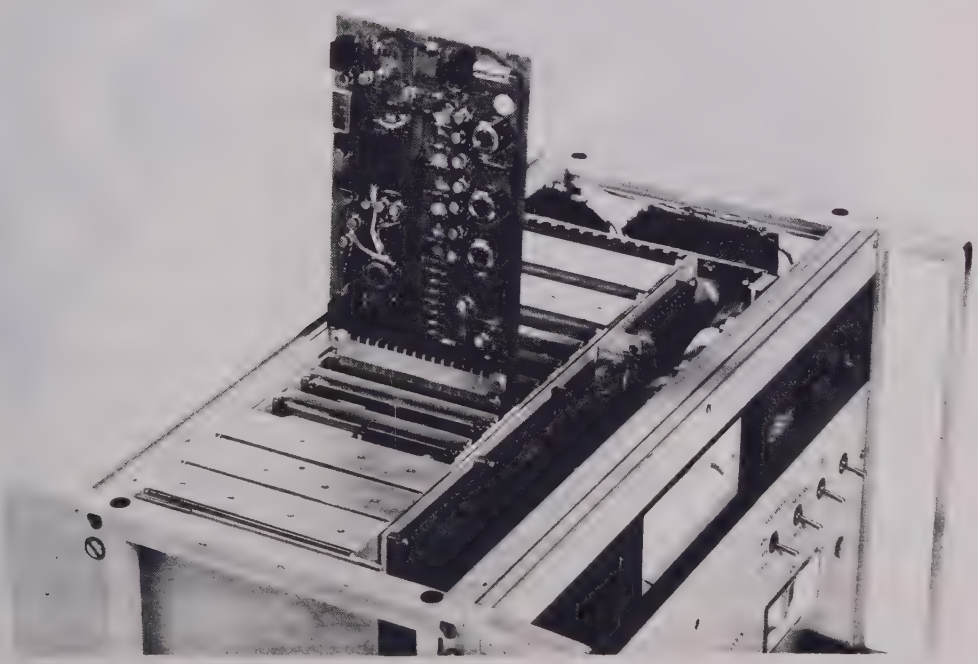
3. Maintenance

The level meter D2007 is so designed that regular maintenance and continuous supervision are not necessary.

However, after a long period of operation the settings in the instrument could change as a result of natural aging of the components. The corrections which are then necessary do not call for any special knowledge.

All the controls used for the following adjustments are, with one exception, accommodated on the PC boards accessible from the top of the instrument. The exception is the adjustment of the supply voltage for the modules, which are set in the power supply section at the side.

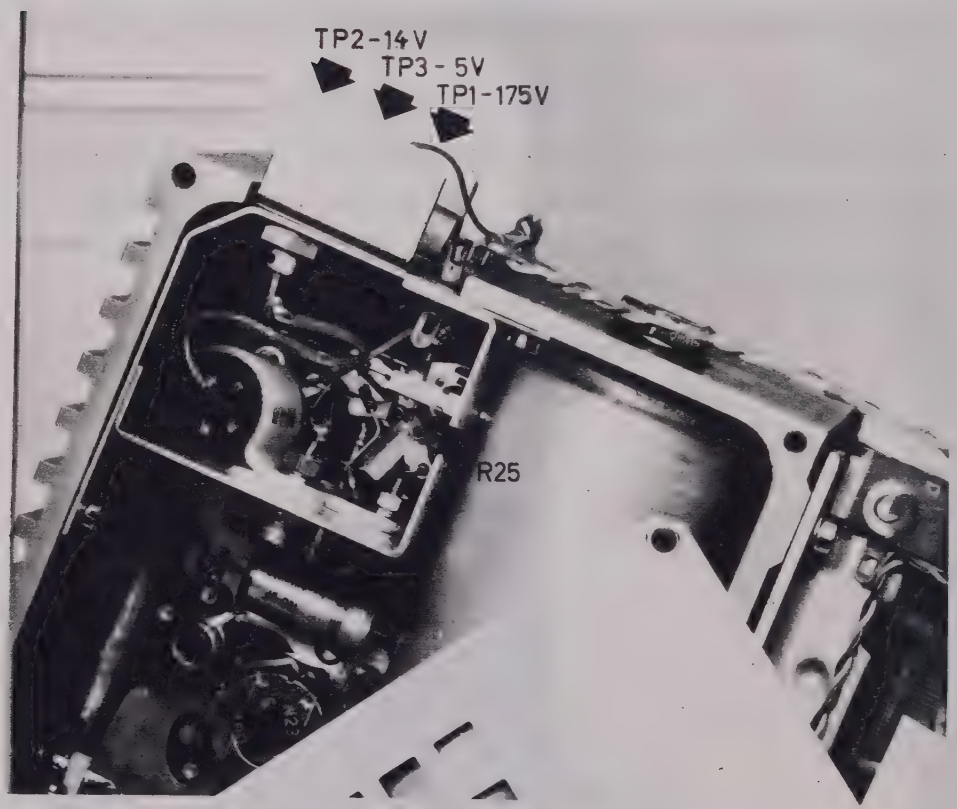
Adjustment to the required values should only be carried out after temperature equilibrium has been reached within the instrument, after approximately 1 hour of operation. For the adjustment the modules should be briefly removed from the module housing or operated via an adapter.



During the adjustment the temperature of the modules concerned must not be allowed to cool excessively below their operating temperature in the enclosed instrument.

All the modules are marked with designations, e.g. "S45034-D5295-A701". In the following sections the modules are referred to by their abbreviated designations only, e.g. D5295. Their position in the instrument is shown on the inside of the top cover.

3.1. Checking and setting the module supply voltages



Operate the level meter D2007 from an ac power (100 to 132 or 200 to 264 V) or dc voltage source (12 to 48 V).

3.1.1. 14 V output

Connect a digital voltmeter between the 16 V output of the power supply (TP2) and the instrument ground.

The voltage measured shall have the value

$$V_{dc} = +14\ V \pm 0.05\ V$$

If this is not the case, but the deviation from 14 V is no greater than ± 0.2 V, adjust the supply voltage for the modules with potentiometer R25 in the power supply to the nominal value $V_{dc} = +14\ V \pm 0.05\ V$.

If the deviation is greater than ± 0.2 V, check the power supply per 4.6.20. in the fault elimination section.

3.1.2. 5 V output

After checking or adjusting the 14 V supply connect the digital voltmeter to the 5 V output of the power supply at TP3.

A dc voltage of $V_{dc} = +5\ V \pm 0.2\ V$ must be indicated on the digital voltmeter.

If this is not the case check the power supply in accordance with 4.6.20. in the fault elimination section.

3.1.3. 175 V output

Likewise after checking or adjusting the 14 V supply connect the digital voltmeter to the 175 V output of the power supply, at TP1, and measure the voltage.

It must have a value $V_{dc} = +170$ to 200 V.

If this is not the case check the power supply in accordance with 4.6.20 in the fault elimination section.

3.2. Checking and setting the frequencies

Operation of level meter D2007 is based on the superheterodyne receiver principle with the triple frequency conversion.

The frequencies required for conversion in the level meter can be checked with a frequency counter at the jacks located on the rear of the instrument.

A frequency counter operating up to 50 MHz with an absolute error $\frac{\Delta f}{f} \leq 5 \cdot 10^{-8}$ is required for these measurements.

3.2.1. Oscillator frequency f_1

Connect the frequency counter to jack Bu17, set the frequency f_1 to 16 MHz locked. Oscillator f_1 then delivers a voltage at a frequency

$$f_{osc} = f_1 + 24 \text{ MHz} \pm \Delta f, \text{ thus in this case}$$
$$f_{osc} = 40 \text{ MHz} \pm \Delta f \ (f_1 \text{ is the value set on the } f_1 \text{ frequency scale}).$$

This frequency (40 MHz $\pm$ Δ f) is indicated on the frequency counter.

If f is greater than $\pm$ 100 Hz, but smaller than $\pm$ 300 Hz, the frequency can be adjusted with trimmer capacitor C8 in module D5276 to the nominal value

$$f_{osc} = 40 \text{ MHz} \pm 10 \text{ Hz}.$$

If the deviation is greater than $\pm$ 300 Hz, proceed in accordance with section 4.5.4. in the troubleshooting instructions.

Then set the frequency f_1 to 1 MHz locked. The frequency $f_{osc} = 25 \text{ MHz} \pm \Delta f$ (with $\Delta f \leq 100$ Hz) must then be indicated on the counter.

If the deviation from 25 MHz is greater than $\pm$ 100 Hz, adjust the frequency at $f_1 = 16$ MHz and $f_1 = 1$ Hz so that the deviation from the nominal frequency is in each case less than $\pm$ 100 Hz (averaging).

On switching to free-running operation of oscillator f_1, the deviation of the oscillator frequency from the set value, i.e. the agreement between the frequency scale and frequency, shall be less than $\pm$ 10 kHz from the nominal value, i.e.

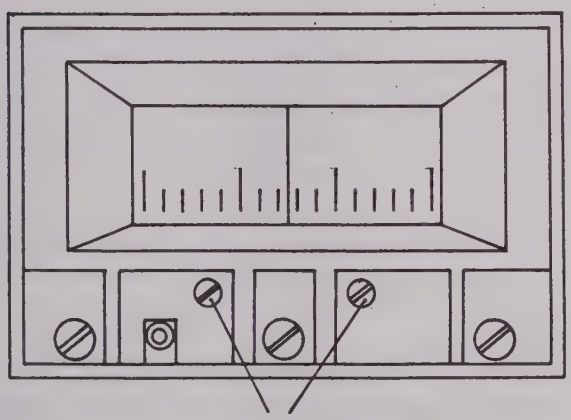
$$f_{osc} = f_1 + 24 \text{ MHz} \pm \Delta f \text{ with } \Delta f \leq 10 \text{ kHz}.$$

The voltage at terminal a of the ceramic terminal strip on

oscillator f_1 measured with a digital voltmeter, must also be set to V_{dc} = +4.5 V ± 0.05 V. This voltage is set with potentiometer R46 on module D5277 in the unlocked mode (S4 in position •◯).

If the deviation Δ f is greater than 10 kHz proceed in accordance with 4.6.1. of the fault elimination section.

If the frequencies indicated on the counter (in the locked and free-running modes) are slightly and roughly uniformly below or above the value set on the frequency scale at all the checked frequency points, this deviation can be corrected by adjusting the scale window (hairline). To do this remove all the controls from the front of the instrument (hexagon socket screw wrench for the control knobs of the film drives in the spare parts bag), remove the escutcheon and loosen the two fillister head screws of the scale window f_1 (about 1 turn). The hairline can then be adjusted.



If the agreement between scale value and frequency checked previously is satisfactory during free-running operation of oscillator f_1, but the locking range is asymmetric to the relevant 100 kHz graduation on the f_1 scale during locked operation, this can be corrected with potentiometer R55 in module D5276.

3.2.2. Oscillator frequency f_2

Remove the coaxial U-connector from jacks Bu15 and Bu16 and connect the frequency counter to jack Bu16. Connect a digital voltmeter to terminal a of the ceramic terminal strip on oscillator f_2 and with the AFC disabled (AFC switch S8 in position ·◯) set the voltage at terminal a with potentiometer P3 (to the right of the f_2 scale) to 7.8 V ± 0.05 V.

The setting f_2 = 0 kHz on the f_2 frequency scale corresponds to a frequency of f_{osc} = 500 kHz indicated on the counter, and the setting f_2 = 100 kHz a frequency of f_{osc} = 600 kHz.

The deviation Δf of the value set on the frequency scale from the associated oscillator frequency shall be smaller than ± 100 Hz, i.e.

$$f_{osc} = f_2 + 500 \text{ kHz} \pm \Delta f \text{ with } \Delta f \leq 100 \text{ Hz}.$$

Correct any parallel shift of the frequencies referred to the f_2 frequency scale in accordance with 3.2.1. If the range of correction possible with the scale window is insufficient, the nominal value of the oscillator frequency can be set with trimmer capacitor C2 in the f_2 oscillator D5278.

If the deviation Δf is greater than ± 100 Hz, proceed according to 4.6.4. of the fault elimination section.

3.2.3. Oscillator frequency f_3

It is a prerequisite for the checking of oscillator frequency f_3 that the frequency deviation of oscillator f_2 from its nominal value is less than ± 100 Hz.

Connect the frequency counter to jack Bu14, set the frequency on the f_2 scale to 0 kHz. The frequency f_3 = 21.6 MHz ± 100 Hz must be indicated on the counter.

If the deviation from f_3 = 21.6 MHz is greater than ± 100 Hz, but smaller than ± 300 Hz, the nominal value can be set using trimmer capacitor C3 on module D5281 (caution! proceed quickly, so that the crystal in module D5281 does not cool down excessively!).

If the deviation is greater than ± 300 Hz, proceed in accordance with section 4.5.6. of the troubleshooting instructions.

Then set the frequency f_2 = 100 kHz on the f_2 scale. The frequency f_3 = 21.5 MHz ± 100 Hz must be indicated on the counter.

If the deviation is still somewhat greater than ± 100 Hz, correct the frequency f_3 with trimmer capacitor C3 (on D5281) so that the deviation from the nominal value is less than ± 100 Hz over the whole frequency range i.e. from 21.6 MHz (corresponding to f_2 = 0 kHz) to 21.5 MHz (corresponding to f_2 = 100 kHz).

3.2.4. Synchronizing frequency f_4

It is a prerequisite for this measurement that the oscillator frequency f_1 has already been checked and the required nominal values obtained.

The synchronizing voltage f_4 = 2.4 MHz is derived from the frequency of the 2.3 MHz crystal oscillator required for the third conversion and 100 kHz obtained by dividing the output of the 1 MHz crystal oscillator required for the f_1 locking. The accuracy of the frequency f_4 is thus also a measure of the accuracy of the 2.3 MHz oscillator.

Connect the frequency counter to jack Bu5. The frequency f_4 = 2.4 MHz ± 20 Hz must be indicated.

If the deviation from 2.4 MHz is greater than ± 20 Hz, but less than ± 100 Hz, set the nominal frequency with trimmer capacitor C17 on module D5290.

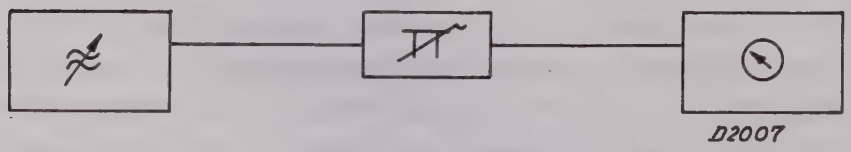
If the deviation is greater than ± 100 Hz, check modules D5290 and D5297 in accordance with 4.6.11. and 4.6.18. in the fault elimination section.

3.3. Checking the expanded level indication (scale-spread device)

A level oscillator (p = +1 dB or +11 dBm, Z = 75 Ω/unbalanced, f = 1 MHz) and a precision variable attenuator with 1 dB steps

(Δ a $\leq \pm$ 0.02 dB) are required for checking the setting of the expanded level indication, i.e. the lower meter scale.

Checking is carried out using the test setup shown below.



p=+1dB/+11dBm	a=0 to 2dB	p=0dB/+10dBm
R_i=75Ω/unbalanced	Z=75 Ω	Z=75 Ω/unbalanced, low-noise
f=1MHz		f=1 MHz, locked
		AFC cut in
		bandwidth: 80 Hz

3.3.1. Set an attenuation a = 1 dB on the variable attenuator. Tune level meter D2007 (level expansion cut out) to the test signal (AFC must lock), then use calibration potentiometer P1 to set the meter pointer of the D2007 exactly to the zero mark (▼) on the upper meter scale.

3.3.2. Test level and frequency remain unchanged. Now cut in the expanded level indication on the level meter (S3 in position ⊙).

The meter indication must change and the pointer must now lie exactly on the zero mark (▼) on the lower scale.

If this is not the case and the deviation is greater than $\pm$ 0.2 dB , examine meter circuit board D5295 in accordance with 4.6.16. of the fault elimination instructions.

If the deviation is less than $\pm$ 0.2 dB adjust the indication with potentiometers R30 and R24 on module D5295 in accordance with the following table (test level and frequency must remain unchanged from the settings for the zero mark on the upper scale):

Variable attenuator setting a (dB)	Indication on D2007 lower scale	Adjustment with ..... in D5295
1	0	R30
0	+1	R24
1	0	R30
0	+1	R24

Repeat the adjustments until no further interaction of the settings can be observed.

When making the setting ensure that module D5295 does not cool excessively!

3.3.3. Test level and frequency remain unchanged. If the variable attenuator is set to a = 2 dB, the meter pointer must move to the -1 dB mark on the lower scale.

If this is not the case and the deviation is greater than $\pm$ 0.05 dB, examine module D5295 in accordance with 4.6.16. of the fault elimination instructions and if necessary recalibrate the meter scale.

3.4. Checking the calibration level

To check the calibration voltage of level meter D2007 a level oscillator which has been switched on long enough for the temperature to stabilize and with the following characteristics is required:

Output level : 0 dB or +10 dBm according to the version of the level meter to be tested
Level error : $\Delta p \leq \pm 0.03$ dB
Frequency : 1 MHz
Output impedance: 75 Ω/unbalanced

Connect the output of the level oscillator via a short 75 Ω coaxial cable to the coaxial input jack of level meter D2007 (Bu1).

Set the switches on D2007 to the following positions:

Z switch S2 ..... 75 Ω/unbalanced
Scale-spread device S3 ..... scale-spread device on (⊙)
Lock-in switch S4 ..... locked (⊙)
Bandwidth switch S5 ..... 6 kHz
Mode of operation switch S6 ..... low-noise
Switch "upper/
lower sideband" S7 ..... as required
AFC switch S8 ..... AFC off (·○)
Sensitivity switch S1 ..... 0 dB or +10 dBm

With oscillator f_1 set to f = 1 MHz locked, tune oscillator f_2 to the test frequency (AFC lamp must light), then use calibration potentiometer P1 to set the meter pointer of the D2007 exactly to the zero mark (▼) on the lower meter scale.

Now press the calibration key T1 of the level meter and check whether the meter pointer again lies on the zero mark (▼) on the lower scale.

If this is not the case set the meter pointer (without moving calibration potentiometer P1 and with calibration key pressed) exactly to the zero mark (▼) on the lower scale with potentiometer P63 on module D5297.

3.5. Checking and setting the pass-band attenuations of the filters

Connect a level oscillator (p = 0 dB or +10 dBm, Ri = 75 Ω/unbalanced, f = 1 MHz) to the coaxial input jack of level meter D2007 via a short coaxial cable; set the level meter as follows:

Sensitivity ..... 0 dB or +10 dBm
Input impedance ..... 75 Ω/unbalanced
Scale-spread device..... on (⊙)
Lock-in ..... on (⊙)
Bandwidth ..... 6 kHz
Measuring mode ..... low-noise
AFC ..... on (⊙)

Tune the level meter to the test signal so that the AFC locks, then set the pointer of the meter in the D2007 exactly to the zero mark (▼) on the lower scale with the aid of calibration potentiometer P1.

3.5.1. Test level and frequency remain unchanged, set the bandwidth switch of the level meter to the "1.74 kHz" position.

The meter pointer must lie exactly on the zero mark of the lower scale, i.e. the pass-band attenuations of the 6 kHz and the 1.74 kHz filters must be the same.

In the case of deviations between ± 0.03 and ± 0.2 dB, the pass-band attenuation of the 1.74 kHz filter D5150 can be adjusted to that of the 6 kHz filter with potentiometer R9 (on D5150). An insulated screwdriver is required for this setting.

If the deviation is greater than ± 0.2 dB, examine module D5150 in accordance with 4.6.13. of the fault elimination instructions.

3.5.2. Test level and frequency remain unchanged (i.e. "0" indication with the 6 kHz filter cut in). Set the bandwidth switch of the D2007 to the "80 Hz" position.

The meter pointer should again lie on the zero mark of the lower scale.

In the case of deviations between ± 0.03 and ± 0.2 dB the pass-band attenuation of the 80 Hz filter D5291 can be adjusted to that of the 6 kHz filter by means of potentiometer R11 (on D5291).

However, if the deviation is greater than ± 0.2 dB, check module D5291 in accordance with the fault elimination instructions, 4.6.12.

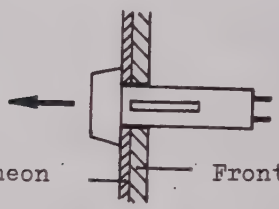
3.5.3. As a check the meter indication of the D2007 should be observed and the bandwidth switch operated again.

The maximum deviation for the bandwidths "80 Hz" and "1.74 kHz" must be ± 0.05 dB, referred to the indication with the 6 kHz bandwidth selected.

3.6. Exchanging the signal lamps

The spare lamps are contained in a spare parts bag, which is accessible after removing the top cover plate.

The signal lamps of the instrument are inserted into holes in the front panel and can easily be pressed out and exchanged after unsoldering the terminal wires.



3.7. Replacing the fuse

The spare fuses are also located in the spare parts bag.

The 0.63 A fuses are provided for ac voltages between 100 and 132 V and the 0.315 A fuses for voltages between 200 and 264 V.

To exchange the fuse unscrew the cap from the fuse holder (at the rear of the instrument). The fuse can then be easily replaced.

4. Fault Location and Fault Elimination

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4.1 General hints

When connecting the instrument, with the cover removed to mains supply the safety regulations (i.e. for Germany the VDE regulations) must be obeyed.

Fault locating and repair should only be carried out by trained personnel. If the type of fault is mentioned in the fault tables **fault locating using the recommendations of the tables considerably shortens fault finding time.**

Data for fault locating **are the fault table, the fault locating** diagrams, the subassembly test instructions and the circuit diagrams - wiring diagrams of the instrument **or of** the subassemblies. The fault table shows which fault locating plan applies to a particular fault. The supply voltages of the subassemblies, the collector base and emitter voltages of the **transistors and the voltages on the relays, reference elements or zener diodes must be measured and compared with the values shown in the circuit diagrams.**

AC voltages, if not specified otherwise, are to be measured with a HF-multimeter, AC voltages specified in V must be checked with an oscilloscope (if necessary with a sampling plug-in). DC voltages are to be measured with a digital voltmeter or /uA multimeter (Ri = 50Kohm/V).

If a faulty component is replaced it may be necessary to re-adjust the frequency response or the modulator. This adjustment must be carried out in accordance with the relevant test instructions.

Should it be necessary to unsolder **transistors or diodes during** fault locating, it must be done as quickly as possible, preferrably using a heat pink. (particularly during removal from double sided **boards.**) If the removed components **are not faulty they should be** soldered into the same position from which they were removed.

Attention: Under no circumstance should the coil slugs be turned. If a fault is suspected in the oscillator or filters, it is **recommended that the connections and contacts be checked. Adjustment on the coils or transformers must only be carried out in accordance with the test instructions (Pv specs.)**

If a fault cannot be positively localised by means of the fault locating diagrams, or if the technical means for repair are not available, the faulty sub-assembly may be returned to the works for repair or exchange.

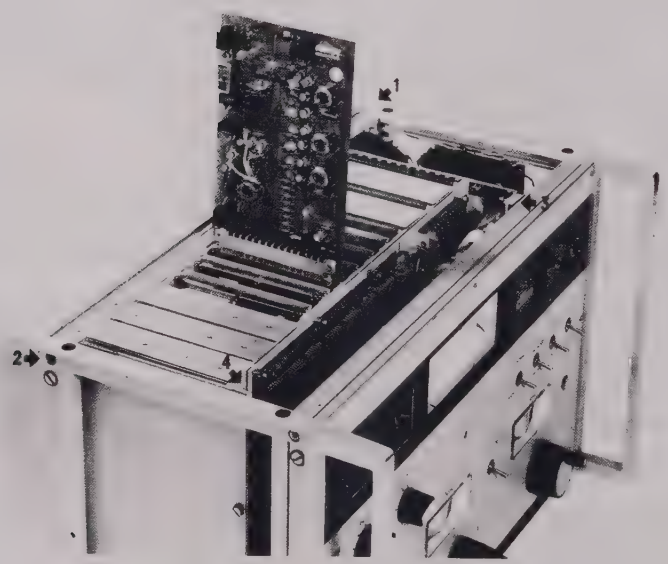
4.2 Film Drive, replacing the filmscale

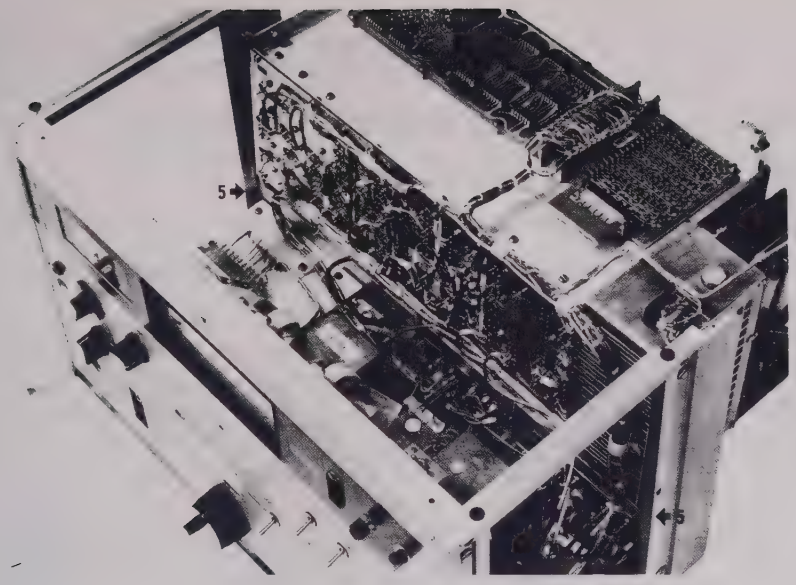
Replacement of the film scale is covered at the end of 4.6.22

4.3 Fault finding with the level meter switched off

If a fault is noticed during switch on of the instrument, check first if this is not due to incorrect operation. For example, the coax-links must be fitted to Bu6/Bu7, Bu15/Bu16 and Bu18/Bu19, and no unattached cable is allowed to be connected to the output connector Bu8.

If the instrument is completely dead (lock-in lamp Lp4 does not light up during lock in, AFC lamps Lp1 fails to light during calibration). Check the mains cable and fuses. Further carry out visual inspection with the covers of the instrument removed. Ensure that the plug-in subassemblies are firmly seated in their sockets. To examine the wiring the motherboard assembly may be folded out of the instrument.





Loosen screws 1, 2, 3 and 4 fold out motherboard assembly from pivot point 5.

4.4 Fault finding table

The left column of the fault finding table shows the type of fault and the right column indicates the appropriate fault finding diagram.

Type of fault	Fault finding PROCEDURE	Section
No lamps light and no digital display	1	4.5.2
f_1 lock in lamp **fails** to light, lock in relay can be **heard to pull in.**	2	4.5.3
f_1 lock in lamp lights continously	3	4.5.4
f_1 lock in lamp and relay not operating	4	4.5.5
f_2 disturbed lamp lights continously	5	4.5.6
Digital indicator tubes do not light up, light up partly or indicate the wrong value	6	4.5.7

Type of fault	Fault finding PROCEDURES	Section
No instrument deflection when pressing calibrate button ie. during calibration	7	4.5.8
Calibration not possible, measurements show errors	8	4.5.9
The divider error of the 10dB steps is greater than ± 0.05 dB	9	4.5.10
The divider error of the 1dB steps (expanded scale) is greater than ± 0.05 dB	10	4.5.11
The frequency response of the level meter deviates from the specified values	11	4.5.12
Switching bandwidth with S5 produces level change greater than ± 0.2 dB	12	4.5.13
Switching from normal to expanded scale produces an error of more than ± 0.2 dB	13	4.5.14
Calibration of probe not possible	14	4.5.15
Oscillator frequency or synchronisation frequency do not correspond to the specified values	15	4.5.16
No voltage at single side band output	16	4.5.17
No voltage at recorder output	17	4.5.18
AFC - indication **does not work.** AFC does not lock-in	18	4.5.19

4.5 Fault finding Procedures

By means of the following fault finding procedures, faulty subassemblies or faulty wiring are relatively easily located.

The level meter D2007 is largely constructed from easily replaceable plug in subassemblies. Even with the multitude of plug in subassemblies, fault finding can be done without undue effort. The input and output signals of each correctly functioning subassembly are clearly defined and often have the same levels. For example all carrier voltages are applied to modulators with 0 dBm on 75 Ohms.

In this way, deviations from the nominal values can easily be identified and the defective subassembly repaired or replaced.

Fault finding is greatly facilitated by the availability of a set of subassemblies or a second level meter. If a certain subassembly seems to be faulty it need only be exchanged for a second subassembly to prove whether it is faulty or not.

Important: It is recommended to mark the subassembly prior to the exchange as the adjustment of some subassemblies influences the overall performance of the instrument.
of the instrument.

In any case the original subassemblies should be returned into the instrument after completion of repair.

4.5.1 Measuring Equipment (Test aids and Data) required for fault finding

Level Oscillator W2007
Level Meter D2021 + G2021 with probe B2023
DC Multimeter $R_i \geq 50K$ ohm/V e.g. Siemens uA multizet
HF Multimeter e.g. HF multizet
Cathode-ray oscilloscope e.g. Siemens wideband oscilloscope oscillar M214 with 10: 1 divider
50 MHz frequency counter (absolute error $\frac{\Delta f}{f} \leq \pm 5.10^{-8}$

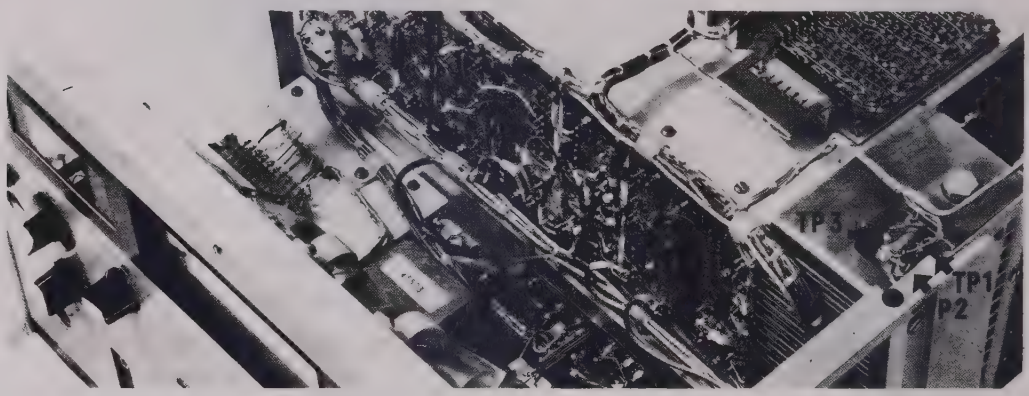
75 ohm termination
adapter S45035-F263-A701
Circuit and wiring diagrams of complete instrument and its subassemblies. (see section 6)

4.5.2 Fault finding procedure No.1

Type of fault: Neither **the Indicator lamps** Lp_1, 2, 3 or 4 nor the digital tubes light up.

Fault finding:

After removing the covers and folding out the mother board the connection points for supply voltages of the subassemblies are visible on the power supply board which is now easily accessible.



Connect the instrument to mains and **switch on with S10**

4.5.2.1 Measure the DC voltages against chassis with µA multimeter (see illustration 4.5.2).

At TP1 - $U_{_}$ = +170 to 210 V
At TP2 - $U_{_}$ = + 14V ± 0.1 V
At TP3 - $U_{_}$ = + 5V ± 0.1 V

4.5.2.2 If there is no voltage **on** these connection points check the equipment fuses (see also maintenance procedure, 3.7.) **If the fuses are in order and mains voltage appears at the** equipment plug (mains lead possibly defective) but no voltage appears at the connection points TP1, 2 and 3, the mains supply subassembly D5301 must be checked according to fault finding procedure D5301 4.6.20.

4.5.2.3 If no voltage appears **on one or more of the three connection** points, check the mains supply subassembly according to fault finding procedure 4.6.20.

4.5.2.4 Should the correct voltages be available on all three test points however with the fault as described, measure the three supply voltages at the connection points of the subassemblies in accordance with circuit diagram S45034-D2007-B102-*-7411 and wiring diagram S45034-D2007-B102-*-7402.

4.5.2.5 If the voltage on TP3, U_{-} = +5 deviates by more than $\pm$0.1 V but less than $\pm$ 0.3 V from the nominal value, adjust to +5V by means of potentiometer R17 in the power supply subassembly.

After adjustment of the 5V a voltage of 170 to 210V must appear on TP1. On TP2 a voltage of 14 V $\pm$0.3 V (this voltage can be adjusted with R25 to 14 V $\pm$0.3 V) must be available.

Should these voltages not be measured or the voltage on TP3 deviates by more than $\pm$ 0.3V from nominal, examine mains supply subassembly according to 4.6.20 of the fault finding procedure.

4.5.3 Fault finding procedure No.2

Type of fault: f_1 lock-in lamp fails to light but pull in of lock-in relay is audible.

Fault finding:
Check the wiring of lock-in relay A1, lock in lamp LP4 and operation of relay contact 5-6-7 in accordance with wiring diagram S45034-D2007-B102-*-7411 and the wiring diagram S45034-D2007-B102-*-7402. If no defect can be established, lamp LP4 must be faulty. Change lamp as described in 3.6 (maintenance)

4.5.4 Fault finding procedure No.3

Type of fault: f_1 lamp lights continuously.

Fault finding:

4.5.4.1 Plug the subassembly D5277 into the instrument with an adapter and check the voltage at pins 20/21 of the 31 pin connector with an oscilloscope.
The voltage as shown for this point on circuit diagram S45034-D2007-B102-*-7411 should be indicated. If this is the case, examine subassembly D5277 in accordance with 4.6.3 of the fault finding procedure.

4.5.4.2 If the voltage shown in the circuit diagram for point 20/21 is not present, measure the HF voltage at pins 1/2 of the 31 pin connector of subassembly D5277 with a HF multimeter

nominal value $U\sim$ = 275mV ± 50mV

If this voltage is present examine subassembly D5276 according to section 4.6.20 of the fault finding procedure.

4.5.4.3 If no HF voltage or too low an HF voltage is measured on pins 1/2 of subassembly D5277 check the HF voltage on pins 9/10 of subassembly D5277,

nominal value $U\sim$ = 275mV ±50mV

Should this voltage not be present, check the f_1 oscillator D5272 according to section 4.6.1 of the fault finding procedure.

4.5.4.4 If no HF voltage or to low a HF voltage is measured on pins 8/10 check the HF voltage on Bu15 of the f_1 oscillator D5272 with this multimeter (for this terminate Bu15 with 75 Ohms).

nominal value $U\sim$ = 275mV ± 50mV

If this is voltage correct, examine the wiring from Bu15 (cable) to pins 9/10 of the connector for subassembly D5277 which is situated on the mother board D5300(measuring point 55).

If the voltage is not present examine the f_1 oscillator D5272 according to section 4.6.1 of the fault finding procedure.

4.5.5 Fault finding procedure No.4

Type of fault: f_1 lock-in lamp Lp 4 does not light, lock in relay A1 does not pull in.

Fault finding:
Switch instrument and "f_1 lock-in" on, adjust f_1 scale to one of the 100 kHz divisions e.g. 1MHz. operate D5277 via an adapter.

4.5.5.1 Measure the DC voltage on pins 30/31 of the 31 pin connector of subassembly D5277

nominal value U_{-} = +14V ± o,1V(against chassis)

If there is no voltage **on pins** 30/31 check the wiring from mains supply subassembly (TP2) via switch S4 and **"the wiring" on the mother board D5300 (measuring point 60) to the sub-unit** D5277.

If the deviation from nominal is greater than ±0.3 V check the mains supply subassembly in accordance with section 4.6.20 of the fault finding procedure.

Deviations up to ± 0.3V can be corrected in accordance with section 3.1.1 (maintenance).

4.5.5.2 **If nominal value $U_{_}$ = +14 V ±0.1 V is present on the pins 30/31 the next step is to measure the DC voltages on pins 26/27 of the 31-pin connector of subassembly D5277.**

Approximately 0V should be measured (turn f_1 scale a little to the left and right to find the lock-in point.

If the voltage measured is approximately 0 V, then check the wiring from pins 26/27 to lock-in relay A1 and the lock-in relay itself.

4.5.5.3 **If instead of zero volts a voltage of +14 V ±0.3 V is measured,** connect an oscilloscope to pin 20/21 of subassembly D5277. The voltage shown in circuit diagram S45034-D2007-B102 for this point should be indicated.

If this is the case examine subassembly D5277 in accordance with section 4.6.3 of the fault finding procedure.

4.5.5.4 If the voltage shown in circuit diagram S45034-D2007-B102-*-7411 for pin 20/21 of subassembly D5277 is not measured, continue to search and eliminate the fault according to 4.5.4.2 to 4.5.4.4.

4.5.6 Fault Finding procedure No.5

Type of fault: **"f_2 disturbed"** lamp lights continuously

Fault finding:

Ensure that subassembly D5281 and D5282 are firmly seated in the instrument and **the connecting link is firmly on Bu15 and Bu16. Remove subassembly D5282 and operate it via an adapter.**

4.5.6.1 Adjust f2 oscillator D5278 to F2 = 0 kHz. Measure the HF voltage at pin 30/31 of the 31 pin connector of subassembly D5282 with an HF multizet. Measure the frequency at this point using a frequency counter.

nominal value U~ = 275mV ± 50mV

f2 = 500KHz ± 200 Hz.

If these values are not measured check the wiring from Bu 22 of the f2 oscillator D5278 to pins 30/31 of the 31 pin socket for subassembly D5282 on the mother board D5300 (measuring point 51) and if necessary examine the f2 oscillator in accordance with section 4.6.4 of the fault-finding procedure.

4.5.6.2 If the nominal values are present at pins 30/31, measure the HF voltages by means of HF multimeter at pins 11/12 of the 31 pin connector. With a frequency counter (connected to the amplifier output of the oscilloscope) check the frequency at pins 11/12 of the 31 pin connector of subassembly D5282.

nominal values U~ = 95mV ± 10mV

f = 500KHz ± 200 Hz

If these values are not measured check the subassembly D5281 (in accordance with 4.6.5 of the fault elimination procedure) and D5282 (in accordance with 4.6.6).

Should the measured values correspond to the nominal values, check subassembly D5282 in accordance with section 4.6.6 of the fault finding procedure.

4.5.7 Fault Finding Procedure NO.6

Type of fault: The digital indicator tubes do not light, or only partly light up, or indicate the wrong value.

Fault Finding:

For fault finding fold out the mother board (see section 4.3).

4.5.7.1 **Check if a plug in plugged into to Bu 8, as the switch contacts** of Bu 8 switch off the digital indication (OV = earth at pin 8 of the 31 pole connector strip of subassembly D5298);

if so remove the plug and check the display again.

4.5.7.2 Checking the supply Voltages.

Switch the level meter on and measure the supply voltages of subassembly D5298 (against pin 1/31 = earth) with a µA multimeter (Multizet)

Pin 2/3 - $U_{_}$ = +5 ± 0.2 V
Pin 19 - $U_{_}$ = +170 to 210 V

If these voltages are not present check the voltages in the mains supply subassembly in accordance 4.5.2.1. If nominal values are measured the wiring from the mains supply on pins 2/3 and 19 of the 31 pole connector **of subassembly** D5298 must be checked.

4.5.7.3 Should the measured values correspond to the nominal values (pins 2/3 and 19) the driver and digital indicators must be tested in accordance with the following table.

Switch S1 Position	Switch S2 Position	Switch S3 Position	Switch S6 Position	Switch S9 Position	Indication	OV = Earth **on pin ... of the 31 pole** connector of D5298
1	1	1	1	1	+ 10	1,6,11,15,31
2	1	1	1	1	+ 0	1,6,11,13,31
3	1	1	1	1	- 10	1,6,11,24,31
4	1	1	1	1	- 20	1,6,11,31
5	1	1	1	1	- 30	1,6,11,14,31
6	1	1	1	1	- 40	1,6,11,16,31
7	1	1	1	1	- 50	1,6,11,12,31
8	1	1	1	1	- 60	1,6,11,23,31
9	1	1	1	1	- 70	1,6,11,21,31
10	1	1	1	1	- 80	1,6,10,11,31
11	1	1	1	1	- 90	1,6,11,17,31
11	1	1	2	1	-110	1,11,17,31
1	3 to 9	1	1	1	+ 20	1,4,6,11,15,31

Switch S1 Position	Switch S2 Position	Switch S3 Position	Switch S6 Position	Switch S9 Position	Indication	OV = Earth at pin. At the 31 pole connector of D5298
1	1	2	1	1	+ 10	1,6,11,15,31
1	1	3	1	1	+ 9	1,6,15,27,31
1	1	4	1	1	+ 8	1,6,15,25,31
1	1	5	1	1	+ 7	1,6,15,28,31
1	1	6	1	1	+ 6	1,6,15,20,31
1	1	7	1	1	+ 5	1,6,15,18,31
1	1	8	1	1	+ 4	1,6,15,22,31
1	1	9	1	1	+ 3	1,6,15,29,31
1	1	10	1	1	+ 2	1,6,15,26,31
1	1	11	1	1	+ 1	1,6,15,30,31
2	1	11	1	1	- 9	1,6,13,30,31
1	1	1	1	2	+ 20	1,5,6,11,15,31

With exception of the supply voltage a DC voltage between 2.0 and 5.2V (TTL=H) must be available at all other pins of the 31 pole connector.

The functions of the switch positions are described in the circuit diagrams S45034-D2007-B102-*-7411 and S45035-D5298-B701-*-7411.

If using the table a fault is established, the wiring from the corresponding switch to the 31 pole connector **of the subassembly** D5298 is to be checked.

If the required voltage is available (Lor H) at the connector strip but the wrong value is still indicated, examine the display logic D5298 in accordance with section 4.6.19.

4.5.8 Fault Finding Procedure No.7

Type of Fault: Pressing the calibrate button produces no deflection on the meter.

Fault finding:

Operate the level meter D2007 without an input. Switch S5 to the 80 Hz filter position. With S3 switch off the expanded scale. Fold out the mother board (as described in 4,3) and set the calibrate potentiometer P1 to approximately mid-position.

During each of the following measurements press the calibrate button (only then can the required voltages be measured).

The HF - voltages are to be measured with a HF multimeter (HF-multizet), the levels with a 25 MHz level meter D2021 & G2021 via probe B2023 and the frequency via an oscilloscope used as an amplifier.

4.5.8.1 With a µA multimeter (1-V-range) check the voltage at the meter terminals. A DC voltage from approximately 200 to 380 mV should be present. If this is the case but the meter shows no deflection the meter is faulty and must be replaced.

If no voltage is present at the meter terminals continue to measure according to 4.5.8.2.

4.5.8.2 With a HF multimeter measure the voltage at measuring point 28 of the mother board D5300 (this is the output of the final amplifier D5294).

nominal value $U\sim = 2.18V \pm 0.2V$

If the nominal values are present check subassembly D5295 according to section 4.6.16 of the fault elimination procedure.

4.5.8.3 With probe plus level meter (f = 100 kHz) measure the level at measuring point 30 of the mother board D5300 (this is the input of 100 kHz final amplifier D5294)

nominal value: $p = -54$ dB ± 3 dB

If the nominal value is measured check the subassembly D5294 according to 4.6.15 of the fault elimination.
If the nominal value is not present proceed according to 4.5.8.4.

4.5.8.4 With probe plus level meter (f = 100 KHz) measure the level at test point 13 of the mother board D5300 (this is the output of the 100 KHz preamplifier D5293).

nominal value $p = -43.5$ dB ± 2 dB

If the nominal value is measured check the wiring from measuring point 13 to connection 20 of the 10 X 1 dB divider D5287. Check subassembly D5287 according to section 4.6.8 and the wiring from connection point 13 of 10 X 1 dB divider D5287 to potentiometer

P1, the potentiometer P1 and resistor R1 and the wiring from potentiometer P1 and **measuring point 30 on the motherboard D5300.** If the nominal value is not measured proceed according to 4.5.8.5.

4.5.8.5 With probe plus level meter (f = 100 KHz) measure the level at measuring point 10 or 11a of the mother board D5300 (this is the output of filter D5291 and D5150).

nominal value P = -27 dB ± 2 dB

If the nominal value is measured, proceed according to 4.5.8.6.

4.5.8.6 Operate subassembly D5293 via an adapter and measure with a µA multimeter the DC voltage at the pins of the 31 pole connector.

Only on pins 9, 12, 13, 14 and 28 should a DC voltage of 14 V ±0.8 V be present.

If this is not the case, check the wiring of calibration button T1 via subassembly D5303 to subassembly D5293. Check subassembly D5303 according to 4.6.21 of the fault elimination procedure and the wiring from the switches to subassembly D5293 (see circuit diagram S45034-D2007-B102-*-7411 and wiring diagram S45034-D2007-B102-*-7402).

If the DC voltage is present at pins 9, 12, 13, 14 and 28 check subassembly D5293 according to 4.6.14 of the fault elimination procedure.

If the nominal values of 4.5.8.5 is not measured proceed according to 4.5.8.7.

4.5.8.7 With probe plus level meter measure again at measuring point **10 or 11a but with the 6 kHz filter switched into circuit** (S5). **If the nominal value is now present the 80 Hz filter, which was previously switched into circuit, is faulty and must be examined according to 4.6.12.**

If the nominal value is **still not present with the 6 kHz filter,** switch in the 1.74 KHz filter. If again the nominal value of 4.5.8.5 is not measured proceed according to 4.5.8.8.

4.5.8.8 With probe & level meter (f = 100 KHz) check the level at measuring point 7 of the mother board D5300 (this is the output of the 3rd modulator D5290).

nominal value p = -26dB ± 2dB

If the nominal value is measured check the input (from S5) to the filters which produced no level at measuring point 10 when switched into circuit. Also check the filters in accordance with 4.6.12 and 4.6.13 respectively of the fault elimination procedure.

If the nominal value is not present at measuring point 7 proceed according to 4.5.8.9.

4.5.8.9 With probe plus level meter f = 2.4 MHz and frequency counter (via oscilloscope connected as an amplifier) check the level and frequency at measuring point 5 of the mother board D5300 (this is the output of the 2 modulator D5289).

nominal value: p = -38dB ± 2 dB
f = 2,4 MHz ± 200 Hz

If the nominal values are present at measuring point 5 check the level and frequency at measuring point 6.

p = -16dB ± 2 dB
f = 2.3 MHz ± 200 Hz

If the nominal values are available at measuring points 5 and 6 then examine the subassembly D5280 according to 4.6.11 of the fault elimination procedure.

If the nominal value is not measured at measuring point 5 even though values at point 6 are correct, proceed according to 4.5.8.10.

4.5.8.10 Using a HF multimeter and frequency counter measure the voltage and frequency at a measuring point 4 of the mother board D5300

nominal value $U_{\sim}$ = 275 mV ± 50 mV

f = 21.6 MHz to 21.5 MHz

depending on adjustment of f2 oscillator (f2 scale)

in other words f = 21.6 MHz - f_2 ± 200 Hz

4.5.8.11 If the nominal values are not present at measuring point 4 check the voltages and frequency at measuring point 50.

nominal value $U_{\sim}$ = 275 mV ± 50 mV

f = 21.6 MHz - f_2 ± 200 Hz

If the values are correct at measuring point 50 then check the wiring from measuring point 50 to connectors Bu6, 7 and 23, the wiring in the f_2 oscillators D5278 from connector Bu 23 to connector Bu 24 and the wiring from connector Bu 24 to measuring point 4.

If the nominal values are not measured at measuring point 50 examine subassemblies D5278, D5281 and D5282 according fault finding procedure No.5 (4.5.6).

If the values at measuring point 4 are correct (4.5.8.10) proceed according to 4.5.8.12.

4.5.8.12 With probe plus level meter (24 to 23.9 MHz) and the frequency counter (via the oscilloscope connected as amplifier) measure level and frequency at measuring point 3 of the mother board D5300.

nominal value p = - 43 dB ± 2 dB

f = 24 MHz -f_2 ± 200 Hz

depending on adjustment at f_2-oscillator (f_2 scale)

If the values at measuring points 3 and 4 are correct examine subassembly D5289 according to 4.6.10 of the fault elimination procedure.

If the nominal values are not present at measuring point 3, proceed according to 4.5.8.13

4.5.8.13 Using a HF-multimeter and a frequency counter measure the voltage and frequency at measuring point 2 of the mother board.

nominal value $U_{\sim}$ = 275 mV $\pm$ 50 mV
f = 21.6 mV $-f_2 \pm$ 200 Hz

If the measured voltage corresponds to the nominal value but the frequency is greater ($f = f_1$ + 24 MHz), f = value of the f_1 film scale) examine the subassembly D5275 according to 4.6.4 of the fault elimination procedure.

If the measured voltage does not correspond with the nominal value (frequency is correct) examine subassembly 4.6.4 of the fault elimination procedure 4.6.4)

If nominal values are measured at measuring point 2 proceed according to 4.5.8.14.

4.5.8.14 With probe plus level meter (2.4 MHz) and the frequency counter via oscilloscope connected as an amplifier) check level and frequency at measuring point 1 of the main wiring.

nominal value p = -39 dB $\pm$ 0.5 dB
f = 2.4 MHz $\pm$ 200 Hz

If the nominal values are present check the **subassembly** D5288 according to 4.6.9 of the fault elimination procedure.

If the nominal values are not measured at measuring point 1 proceed according to 4.5.8.15

4.5.8.15 Using a µA multimeter (30V range) measure the DC voltage at measuring point 38 of the mother board whilst the calibration button is being pressed. A voltage $U_{_}$ = +14V ± 0.2V should be measured. **If this is not the case check the wiring from power** supply (TP2 via the calibration push button T1 to the measuring point 38. If the wiring is intact but the required voltage does not appear at measuring point 38 the calibration push button T1 is probably faulty. Check the push button and if necessary replace it.

If the required voltage is measured at measuring point 38 and the required HF voltage appears **on measuring** point 6 **(or 36a) (see 4.5.8.9) check the voltage and frequency at measuring** point 41.

A 100 kHz square wave having an amplitude of

$$U_{ss} = 1.7 \text{ to } 3.3 \text{ V}$$ should be present.

Should this voltage **be present at measuring point 53 but not at** measuring point **41 check** the wiring from measuring point 53 to measuring point 41. If the voltage does not appear at measuring point 53 examine subassembly D5276 according to 4.6.2 of the fault elimination procedure.

If the required values are measured at points 6 **(or** 36a), 38 and 41, proceed according to 4.5.8.16.

4.5.8.16 With probe plus level meter (2.4 MHz) and frequency counter (via oscilloscope connected as amplifier) measure level and frequency at measuring point 39 of the mother board.

nominal value p = -49dB ± 0.2 dB

f = 2.4 dB ± 200 Hz

If these values are not measured, examine the subassembly D5297 according to 4.6.18.

If the values are measured at measuring point 39 of the mother **board, remove the plug from Bu 26 and measure on the plug, then replace the plug and proceed according to 4.5.8.17.**
(Bu 28 is the connection to the measuring circuit D5283).

With the Calibration pressed, (as was the case churing the previous measurement) check the DC voltages with a µA multimeter (30 V range) at the 21 pole connector of the measuring circuit D5283.

Pins 6, 10, 11, 16 and 17 should carry a DC voltage of +14V ± 0.8V (the voltages on the other pins are not relevant to this type of fault). If this is not the case check the wiring from calibrate button T1 via subassembly D5303 to the connector of the measuring circuit. Also check subassembly D5303 according to 4.6.21 of the fault elimination procedure.

If the required voltage is present at pins 6, 10, 11, 16 and 17 and also the HF voltage required under 4.5.8 is available at connector Bu 26, but the nominal values stated under 4.5.8.14 are still not measured at measuring point 1 of the mother board;examine the subassembly D5283 according to 4.6.7 of the fault elimination procedure.

4.5.9 Fault finding procedure No.8

Type of fault: The D2007 can be calibrated but errors occur during measurement.

4.5.9.1 Connect a level oscillator W2007 to the input of the D2007. To the output connector Bu 25 of the measuring circuit in the D2007 connect a further level meter D2007 (II) synchronised with the W2007. Frequency response and divider error of the oscillator and the level meter D2007/II must be known.

Check the operation of the measuring circuit according to the following table (D2007/I in position low distortion).

Instruments with level matrix -D5303-A701

Transmit level	D2007/I Indication	Level at Measuring panel output (Bu 25)
-50 dB	-40dB (-30dBm)/75 Ohm	-90 dB
-50 dB	-50dB (-40dBm)/75 Ohm	-80 dB
-50 dB	-60dB (-50dBm)/75 Ohm	-70 dB
-50 dB	-70dB (-60dBm)/75 Ohm	-60 dB
-50 dB	-80dB (-70dBm)/75 Ohm	-50 dB
-50 dB	-90dB (-80dBm)/75 Ohm	-40 dB
-50 dB	-100dB (-90dBm)/75 Ohm	-30 dB
-50 dB	-40dB (-30dBm)/124 Ohm	-90 dB
-50 dB	-40dB (-30dBm)/135 Ohm	-90 dB
-50 dB	-40dB (-30dBm)/150 Ohm	-90 dB

Instruments with level matrix - D5303-B701

Transmit Level	D2007/I	Level of Measuring panel output (Bu 25)
-50 dB	-40dB (-30dBm)/75 Ohm	-90 dB
-50 dB	-50dB (-40dBm)/75 Ohm	-80 dB
-50 dB	-60dB (-50dBm)/75 Ohm	-70 dB
-50 dB	-70dB (-60dBm)/75 Ohm	-60 dB
-50 dB	-80dB (-70dBm)/75 Ohm	-60 dB
-50 dB	-90dB (-80dBm)/75 Ohm	-50 dB
-50 dB	-100dB (-90dBm)/75 Ohm	-40 dB
-50 dB	-110dB (-100dBm)/75 Ohm	-30 dB
-50 dB	-40dB (-30dBm)/124 Ohm	-90 dB
-50 dB	-40dB (-30dBm)/135 Ohm	-90 dB
-50 dB	-40dB (-30dBm)/150 Ohm	-90 dB

4.5.9.2 If the values mentioned under 4.5.9.1 are not obtained check the drive to the measuring panel in accordance with the following table (+14V ± 1 V on pin.....)

Instruments with level matrix -D5303-A701

D2007/1 Indication	Voltage on pin..of the 21 pole connector at D5283
-40dB (-30dBm)/ 75 Ohm	6, 12/13, 21
-50dB (-40dBm)/ 75 Ohm	5, 12/13, 21
-60dB (-50dBm)/ 75 Ohm	6, 14/15, 21
-70dB (-60dBm)/ 75 Ohm	5, 14/15, 21
-80dB (-70dBm)/ 75 Ohm	6, 18/19, 21
-90dB (-80dBm)/ 75 Ohm	5, 18/19, 21
-100dB (-90dBm)/75 Ohm	18/19, 21
-40dB (-30dBm)/124 Ohm(2MHz)	5, 12/13, 1
-40dB (-30dBm)/135 Ohm	5, 12/13, 2
-40dB (-30dBm)/150 Ohm	5, 12/13, 3
-40dB (-30dBm)/124 Ohm(10 MHz)	5, 12/13, 4

Instrument with level matrix D5303-B701

D2007/I Indication	Voltage at pin of the 21 pole connector at -D5283.
-40dB (-30dBm)/ 75 Ohm	6, 12/13, 21
-50dB (-40dBm)/ 75 Ohm	5, 12/13, 21
-60dB (-50dBm)/ 75 Ohm	6, 14/15, 21
-70dB (-60dBm)/ 75 Ohm	5, 14/15, 21
-80dB (-70dBm)/ 75 Ohm	5, 14/15, 21
-90dB (-80dBm)/ 75 Ohm	6, 18/19, 21
-100dB (-90dBm)/ 75 Ohm	5, 18/19, 21
-110dB (-100dBm)/ 75 Ohm	18/19, 21
-40dB (-30dBm)/ 124 Ohm (2.2 MHz)	5, 12/13, 1
-40dB (-30dBm)/ 135 Ohm	5, 12/13, 2
-40dB (-30dBm)/ 150 Ohm	5, 12/13, 3
-40dB (-30dBm)/ 124 Ohm (10 MHz)	5, 12/13, 4

4.5.9.3 **If the voltage is present at the pins mentioned under 4.5.9.2** but the values stated under 4.5.9.1 are not achieved, examine the measuring circuit D5283 according to 4.6.7 of the fault elimination procedure. If the voltages are not present on the pins mentioned under 4.5.9.2 examine the wiring from switch S1 to the level matrix -D5303 and the matrix itself according to section 4.6.21 of the fault elimination procedure, **also check** the wiring from the level matrix to the 21 pole connector of the measuring circuit **and the wiring from the Z switch to S2 of the measuring circuit.**

4.5.9.4 Should the values stated under 4.5.9.2 and 4.5.9.3 be present **but either no indication or an incorrect indication is given on the meter of the D2007, check the drive to the 100 kHz pre-amplifier** D5293 in accordance with the following table (D2007 in position low noise)

D2007/I Indication	Voltage (14V ± 1V) at pin of D5293	
	dB instruments	dBm instruments
+10dB (+20dBm)/ 75 Ohm	10, 12, 28	10, 12, 26
0dB (+10dBm)/ 75 Ohm	9, 12, 28	9, 12, 26
-10dB (0dBm)/ 75 Ohm	9, 12, 28	9, 12, 26
-20dB (-10dBm)/ 75 Ohm	9, 12, 28	9, 12, 26
-30dB (-20dBm)/ 75 Ohm	9, 12, 28	9, 12, 26
-40dB (-30dBm)/ 75 Ohm	9, 12, 28	9, 12, 26
-50dB (-40dBm)/ 75 Ohm	9, 12, 28	9, 12, 26
-60dB (-50dBm)/ 75 Ohm	9, 12, 28	9, 12, 26
-70dB (-60dBm)/ 75 Ohm	10, 11, 12, 28	10, 11, 12, 26
-80dB (-70dBm)/ 75 Ohm	9, 11, 12, 28	9, 11, 12, 26
-90dB (-80dBm)/ 75 Ohm	8, 11, 12, 28	8, 11, 12, 26
+10dB (+20dBm)/124 Ohm	10, 12, 28	10, 12, 24
+10dB (+20dBm)/135 Ohm	10, 12, 28	10, 12, 22
+10dB (+20dBm)/150 Ohm	10, 12, 28	10, 12, 21

If the drive corresponds to the above table, examine subassembly D5293 according to 4.6.14 of the fault elimination. If the drive is incorrect check the wiring to switch S1 to the level matrix and to the 100 KHz preamplifier. Check the level matrix according to 4.6.21 of the fault elimination procedure and check the wiring from the level matrix to the 100 KHz preamplifier and from switch S2 to 100 KHz preamplifier.

4.5.10 Fault Finding Procedure No.9

Type of fault: The divider error of the 10 dB steps is greater than ± 0.05 dB.

Fault Finding:

If deviation of greater than ±0.05 dB from the nominal value has been determined for the 10 dB step divider, check in accordance with the table in 4.5.9.1 of the fault finding procedure whether the fault is in the divider or the amplifier stages in the measuring circuit or in the divider steps in the 100 kHz preamplifier. If necessary the measuring circuit, can then be repaired according to section 4.6.7 and the 100 kHz preamplifier in accordance with section 4.16.14 of the fault finding procedure.

4.5.11 Fault Finding Procedure No. 10

Type of fault: The divider error of the 1dB step divider (expanded scale) is greater than ±0.05 dB

Fault Finding:

If a deviation of greater than ± 0.05 dB from nominal value has been determined for the D2007 check the 10 X 1 dB divider D5287 in accordance with section 4.6.8 of the fault elimination procedure.

4.5.12 Fault Finding Procedure No.11

Type of fault: The frequency response deviates from that stated in the specification.

Fault Finding:

Check the frequency response of the measuring circuit using the information given in section 4.6.7 and the frequency response of the 1st modulator in accordance with section 4.6.9.

4.5.13 Fault Finding Procedure No.12

Type of Fault: A level difference greater than ± 0.2 dB occurs when changing bandwidth (switch S5)

Fault Finding:

Proceed in accordance with section 3.5 (maintenance).

4.5.14 **Fault Finding Procedure No. 13**

Type of fault: Switching from normal operation to operation with scale spread, produces an error greater than ±0.2 dB.

Fault Finding:

Proceed in accordance with section 3.3 (maintenance).

4.5.15 Fault Finding Procedure No.14

Type of fault: Calibration of measuring probe is not possible (see also section 2.6.1, operation)

Fault Finding:

4.5.15.1 With calibration button depressed (probe not connected to Bu 4) measure the voltage at pin 16/17 of the 21 pole connector of the measuring circuit. A voltage $U_{_}$ = +14V ±1 V should be present.

If this is not the case, examine the wiring from calibration button T1 to connection 2 to strip I of the level matrix and check the matrix according to Section 4.6.21. Further examine the wiring from pin 5 to strip II of the level matrix

to the contacts at Bu 5 (probe power supply) and from there to pin 16/17 of the 21 pole connector strip of the measuring circuit. **Now operate the switch contact of Bu 4 (by plugging in a suitable 5 pole plug). The voltage must appear at pins 18/19 of the measuring circuit but should no larger be applied to pins 16/17. If this not the case, determine the cause of the fault as before, in particular the contact set of Bu 4 should be carefully checked.**

If the correct voltages appear at pin 16/17 **and 18/19** of the measuring circuit, the level meter operates in normal operation and can be calibrated, proceed in accordance with section 4.5.15.2.

4.5.15.2 Connect a second level meter D2007 to Bu 3 (it is possible to use the faulty level meter for this measurement provided it is otherwise **operational: in** this case connect Bu 3 with Bu 1) and measure the output level at Bu 4 with high impedance. The following level should be measured.

$$p = -49dB \pm 0.2\ dB \text{ at a frequency of}$$
$$f = 2.4\ MHz \pm 200\ Hz$$

Is this not the case check the wiring from pin 17/18 of the calibrate generator -D5297- to connector Bu 3. If the wiring is intact examine the calibrate generator -D5297- according to section 4.6.18.

4.5.16 Fault Finding Procedure 15

Type of Fault: **The oscillator and synchronisation frequencies do not correspond to their nominal values.**

Fault Finding:

Proceed in accordance with section 3.2 (maintenance).

4.5.17 Fault Finding Procedure No.16

Type of fault: No voltage **at the single sideband** output (SSB-Headphone)

Fault finding:
Provided the level meter is otherwise functional i.e. instrument

reads, measure the level at Bu 12 of the D2007 with a level meter (f= 1.35 KHz, p = 0dB, Z = 600 Ohms).

The nominal level is p = 0 dB ± 1 dB at a frequency of
f = 1.35 KHz ± 100 Hz

If these values are not measured examine the measuring circuit D5295 according to section 4.6.16 of the fault elimination procedure.

4.5.18 Fault Finding Procedure No.17

Type of fault: No voltage appears at the recorder output (DC output).

Fault Finding:

Provided the level meter is otherwise functional, i.e. instrument reads, measure with a µA multimeter or digital voltmeter the voltage between a and b conductor of jack Bu 13 whilst the instrument indicates p = 0dB. If the value $U_{_}$ = 200 mV ± 20 mV is not measured examine the measuring circuit -D5295- according to 4.6.16 of the fault elimination procedure.

4.5.19 Fault Finding Procedure No.18

Type of Fault: AFC indication has failed, the AFC does not lock in.

Fault Finding:

4.5.19.1 First determine if the lock in lamp LP1 is faulty. If the lamp is not faulty, proceed according to 4.5.19.2.

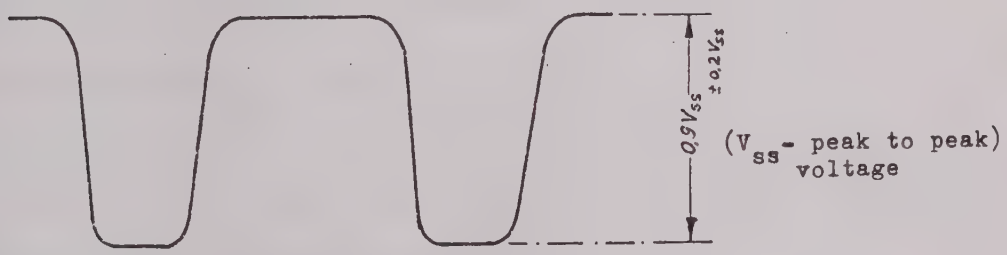
4.5.19.2 With the AFC switched on (switch S8 in position 0) measure with a µA multimeter or a digital voltmeter the voltage at the connection point a of the ceramic solder strip of the f_2 oscillator -D5278-. It should be $U_{_}$ + 7.8 V ±50 mV, adjustable with potentiometer P3 on the front panel of D2007. Is this not the case check the wiring between the f_2 oscillator the potentiometer P3 and the AFC board -D5296- in accordance with the circuit diagram S45034-D2007-B102-*-7411 and the wiring diagram S45034-D2007-B102-*-7402. If the wiring is in order and the voltage $U_{_}$ = +7.8V ± 50mV appears at pin 21/22 of the AFC board - D5296- the relay Y of the subassembly

or the drive to the relay from switch S8 is probably defective.

Should the nominal voltage be present at connection a of the F_2 oscillator proceed according to 4.5.19.3.

4.5.19.3 With an oscilloscope measure the voltage at pin 9/10 of the AFC board -D5296-. The wave shape and amplitude as indicated in the circuit diagram S45034-D2007-B102-*-7411 must be present. If this is not the case check the 1 MHz oscillator -D5276- according to section 4.6.2. If the required voltage is present at pin 9/10 proceed according to 4.5.19.4

4.5.19.4 Applying an input level of 0dB (+ 10dBm) to the level meter D2007 measure the voltage at pin 3/4 of the AFC board, using an oscilloscope.



If this voltage is not measured examine subassembly -D5150- according to section 4.6.13.

4.5.19.5 If the required voltage is measured at pins 9/10 and 3/4 of the AFC board and the frequencies correspond (± 100 Hz) the AFC should lock in with AFC switched on. If this is not the case examine subassembly-D5295- according to section 4.6.17.

4.6 Fault Elimination Procedure

Hints on fault elimination

If as a result of following the fault finding procedure a faulty subassembly has been located a visual inspection is recommended. Overloaded resistors and coils are generally easily located due to thier overheated apperrance. Prior to the replacement of such parts ascertain and eliminate beyond doubt the cause of the failure. (for example examine associated transistors, capacitors, or diodes for short circuits).

Should a transformer or coil be suspected or found faulty, never turn their tuning slugs during the visual inspection.

The fault elimination can be carried out with the aid of the tests described in the following section. The plug-in subassemblies **can be connected, as was the case during fault finding** via an adapter to the level meter. Only the oscillator f_1 and f_2, the measuring circuit, level indicator logic, level matrix and the power supply remain connected in the instrument.

The measuring equipment and accessories are grouped according to each of the subassemblies described.

4.6.1 f_1 Oscillator D5272

The oscillator f_1 consists **of** the main of the oscillator circuit and the subsequent amplifier stages.

The frequency f_1, adjusted on its filmscale (0 to 18.6 MHz), corresponds to an oscillator frequency $f_{osc.\ 1}$ which is higher by 24 MHz (24 to 42.6 MHz). This frequency drives the 1st modulator of the level meter.

$$f\ osc_1 = f_1 + 24\ MHz \pm \Delta f$$

4.6.1.1 Measuring equipment and accessories required.

1 oscilloscope with divider probe eg Siemens Oscillar M214
1 frequency counter to 50 MHz
1 digital voltmeter
1 level meter **50 MHz, 75 Ohm eg** D2072
1 /uA multizet (Multimeter) ($R_1 \cong$ 50K Ohm/V)
1 **oven +10 to +** 60°C

4.6.1.2 Preparation:

To gain access to all measuring points at and in the oscillator remove all the covers **from the instrument. Fold out the mother** board (see section 4.3). The cover on the base of the instrument must also be removed.

4.6.1.3 Remarks:

The f_1 oscillator D5272 is TK compensated (never adjust the TK-trimmer C16 in the oscillator). Should it be necessary to **replace a frequency determining component (any new capacitor** fitted must definately have the same TK value of the original component) a new TK compensation adjustment is necessary and the frequency scale **must be checked.**

If the frequency indicated on the film scale does not correspond to that of the oscillator adjust the film scale according to section 3.2.1 (maintenance). Should this adjustment be insufficient the film scale has then to be redrawn. (preferably return the f_1 oscillator to the works).

4.6.1.4 **Current consumption of the f_1 Oscillators**

Set switch "S4" of the D2007 to **"lock-in off -.0". Remove the** supply voltage $U_{_}$ = +14V $\pm$ 0.2V from connection point "C" and "f" of the ceramic soldering strip at the oscillator and reconnect **it via a /uA multimeter (100 mA range).**

The current indicated by the multimeter should be

$$Io = 55 \text{ mA } \pm 10 \text{ mA}$$

4.6.1.5 DC Voltage

The following DC voltages are to be measured with a digital voltmeter (or /uA multizet) against the housing of the oscillator.

Voltage **on** C44, C45 and C46-UC44 = +14V $\pm$0.1 **V**(if necessary adjust R25 in the power supply).

Voltage **on** C43 - U C43 = +4.5V $\pm$ 0.05V (if necessary adjust R46 in D5277).

U(V)	Ts1	Ts2	Ts3	Ts4	Ts5
U_C	9.0-11.0	12.7-13.7	13.5-14.0	13.5-14.0	13.0-14.0
U_B	1.7-2.7	6.0-7. 0	4.8-6. 2	2.2-2. 8	6.1-7. 1
U_E	1.1-1.5	4.9-6. 9	4.0-5. 6	0	5.5-6. 5

U(V)	Ts6	Ts7	Ts8
U_C	11.6-12.6	13.0-14.0	11.6-12.6
U_B	4.4-5.4	6.1-7. 1	4.4-5.4
U_E	3.8-4.8	5.5-6. 5	3.8-4.8

4.6.1.6 Output Voltage:

Operate the f_1 - oscillator free running (S4 in position .0, +14V $\pm$ 0.1V on 44, C45 and 46 + 4.5V $\pm$ 0.05V on C43) with f_1 = 1 MHz (f osc 1 = 25 MHz).

With a level meter (75 Ohm/coaxial f = 25 MHz) measure at Bu 17 the output voltage of the f_1 oscillator and if necessary adjust potentiometer R30 to p= 0 dBm $\pm$ 0.2 dB.

4.6.1.7 Frequency response of the output voltage

The level meter remains connected to Bu 17. With the f_1 oscillator free running tune the oscillator f= 0 to 18.6 MHz this corresponds to the oscillator and level meter frequency 24 to 42.6 MHz. The output level referred to 1 MHz should be p = 0 dBm $\pm$ 2 dB.

4.6.1.8 Wave shape of the output voltage

In addition to the level meter connect an oscilloscope to Bu 17. Over the entire frequency range of the f_1 oscillator the oscilloscope should show a pure sine wave.

4.6.1.9 Frequency Range:

With the f_1 oscillator still in the free running mode connect **a frequency counter to Bu 17. At the left stop of the tuning** knob, the counter should read less than 23.9 MHz and at the right hand stop greater than 42.7 MHz.

4.6.1.10 Regulating range of the capacitance diode

From connection point "a" on the ceramic soldering strip of the f_1 oscillator unsolder the wire coming from the instrument. **In place of the wire connect a DC power supply (approx 3 to 6 V variable). The frequency counter remains connected to Bu 17. Adjust** the oscillator so that the counter shows approximately 24 MHz.

Now vary the voltage at C43 by means of the power supply from 3V $\pm$ 50 mV to 6V $\pm$ 50 mV **and monitor the voltage. The resulting** frequency variation should be 24 to 32 **kHz**. The same measurement must be repeated at a frequency of 42 MHz. The resulting frequency change should now be 25 to 37 **kHz**.

4.6.1.11 TK - adjustment

This adjustment is necessary when frequency determining components are replaced in the oscillator D5273. The f_1 oscillator is to be removed from the D2007. Replace the cover of the oscillator with a cover that has a hole over the TK-trimmer C16. Set the TK trimmer to exactly its middle position.

Terminate the f_1 oscillator at Bu 15 with 75 Ohms. Connect a frequency counter to Bu 17 and apply to connection "C" and "F" of the ceramic soldering strip a DC voltage of $U_{_}$ = 14V $\pm$ 0.1V, at Duco C43 apply a DC voltage of 4.3V $\pm$ 50 mV. Adjust the frequency of the f_1 oscillator at room temperature to approx 40 MHz. Note the value indicated on the frequency counter. **Now place the subassembly; without disturbing the frequency setting and without touching coupling and film drive, with the supply voltage (+14 V $\pm$0.1 and 4.5 $\pm$50 mV) still applied and with frequency counter connected, into an oven and heat the subassembly** to +60°C. After approx 3 hours at +60°C again note the frequency of the f_1 oscillator.

If the frequency difference (oscillator cold - oscillator warm) is greater than 8 kHz, adjust the output frequency at 60°C (by adjusting C16) to that measured at room temperature, using a trimming tool which has also been heated to *60°C.

4.6.1.12 Correspondence of scale frequency:

With voltages U_{C43} = 4.5V ± 50 mV and U_{C44} = +14V ± 0.1V applied, check the output frequency (at Bu 17) with a frequency counter to see if it corresponds with that indicated on the frequency scale. The frequency indicated on the counter is 24 MHz above that shown on the scale. The difference between the value indicated on the film scale and that shown on the counter (-24 MHz) should be less than ± 20 KHz. If this is not the case readjust the film scale according to section 3.2.1 (maintenance).

4.6.2 1 MHz Oscillator D5276

The control signal for lock-in of the f_1 oscillator is derived from a phase comparison in the 1 MHz Oscillator between the 1 MHz frequency divided down to 100 KHz with the frequency of the f_1 oscillator (24 to 42.6 MHz). The square wave voltage obtained from the 1 MHz frequency divided down to 100 KHz is the comparison voltage for the AFC circuit and serves for deriving the calibration voltage.

4.6.2.1 Measuring equipment required

1 oscilloscope with divider probe e.g. Siemens Oszillar M214
1 frequency counter $\frac{\Delta f}{f} \leq 5 \cdot 10^{-8}$
1 µA multimeter $R_i \geq 50$ kOhm/V
1 HF multimeter

4.6.2.2. Current consumption of the 1 MHz Oscillator

The current consumption of the subassembly, measured with the µA multimeter in the 100 mA range, should be

at pin 20/21 - 65 mA ±5 mA
at pin 30/31 - 38 mA ±5 mA

4.6.2.3 Checking the DC Voltage

The following DC voltages are to be measured with a digital voltmeter or a µA multimeter against chassis (pin 3...17)

U(V)	Ts2	Ts3	Ts4	Ts5
U_C	12.3-13.3	4.6-5.2	4.6-5.2	13.5-14.0
U_B	1.3-1. 9	0.8-1.4	1.2-2.2	0
U_E	0.7-1. 3	0.1	1.0-2.0	0

U(V)	Ts6	Ts7	Ts8	Ts9
U_C	13.5-14.0	5.9-7.9	6.3-8.3	11.0-13.0
U_B	0	1.0-2.0	1.5-2.5	6.3-7. 8
U_E	0	0.4-1.4	0.9-1.9	6.2-7.2

U(V)	Ts10	Ts11	Ts12	Ts13
U_C	11.0-13.0	9.9-11.9	7.9-9.9	10.5-12.5
U_B	4.9-5.9	4.2-5. 2	5.4-6.4	4.7-5. 7
U_E	4.3-5.3	3.6-4.6	5.3-6.3	5.6-6. 4

4.6.2.4 Adjusting the Oscillator and frequency adjustment.

Connect the subassembly via an adapter to the level meter D2007 and operate the level meter in the lock-in mode (switch S4 in position ⊙).

With the trimmer C8 in mid position (half closed) connect a uA multimeter (300 mV range) to the resistor R3 (+pole at soldering pin 9, - pole at soldering pin 1. Adjust the tuning slug of transformer U1 to maximum deflection on the multimeter.

nominal value 105mV $\geq$ U max $\geq$ 55 mV

Using an oscilloscope with a 10:1 divider probe measure the voltage at soldering pin 3 (base of TS3) this should be 7.5 V_{ss} $\leq U_{ss} \leq$ 9.5 V_{ss}. Now measure at soldering pin 4 (emitter of TS3) which should be the value stated in the circuit diagram.

Connect a frequency counter to the amplifier output of the oscilloscope which is still connected to soldering pin 4. By means of trimmer C8 adjust the oscillator frequency to f= 1 MHz $\pm$ 1 Hz (ATTENTION! for this adjustment the oscillator must be at operating temperature see also maintenance section 3.2.1)

Now connect the oscilloscope (with frequency counter connected) to soldering pin 5 (this is output 12 of the SN 7490N) and chassis. The counter reading should be f= 100 KHz ± 1 Hz.

4.6.2.5 Adjusting the pulse voltage

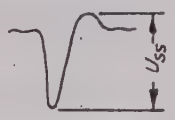
Connect the oscilloscope to soldering pin 6 (R25 against chassis) and adjust the pulse voltage with potentiometer R22 to Uss = 2.2V ± o.1V.

The wave shape of this pulse voltgage and other voltages are shown in the circuit diagram of the subassembly.

4.6.2.6 Checking the Phase Modulater

Connect the oscilloscope via the 10:1 divider probe to the base of Ts 7.
The maximum amplitude should be

Uss = 0.21 to 0.30V



If this value is not obtained, check again point 4.6.2.5.

4.6.2.7 Checking the amplifier

Connect the oscilloscope via the 10:1 divider probe to soldering pin 8. The wave shape and amplitude shown in the circuit diagram must be measured.

4.6.2.8 Checking the amplifier

Connect the oscilloscope via the 10:1 divider probe to pins 18/19 of the 31 pole connector strip. The amplitude and wave shape of the output voltage as shown in the circuit diagram should be measured.

4.6.2.9 Adjusting the Schmitt-Trigger

Set the film scale of the f_1 oscillator to 18 MHz in the lock-in mode (this means 42 MHz at pin 1/2 of the 1 MHz oscillator) Connect the oscilloscope with sampling plug-in) via the 10:1 divider probe to soldering pin 10 (collector of Ts 13). Adjust potentiometer R73 to the sampling ratio of 1:2 as indicated in the circuit diagram.

4.6.3 Filter and amplifier D5277

The filter contains a 50 KHz low pass filter, the amplifier stages and rectifier for the f_1 lock-in indication. The amplifier is a buffer amplifier between the f_1 oscillator and the 1 MHz oscillator. Apart from this the subassembly contains the circuit for preparing the control voltage for the capacitance diodes of the f_1 oscillator for its free running operation.

4.6.3.1 Measuring equipment and accessories required

1 50 MHz oscilloscope e.g. Siemens Oscillar M214
1 Frequency Counter
1 Level Oscillator e.g. W231 (1.6 MHz)
1 Level Meter e.g. D354 (1.6 MHz)
1 Digital Voltmeter
1 HF MULTIMETER
1 Resistor, 27 KOhm ±5 % 0.2 W
1 Capacitor 1.5 µF ±20 %, 25 V
1 DC power supply 17.5 V ± 0.1V
1 DC power Supply 14V ± 0.1V

4.6.3.2 Current Consumption

For this measurement remove the subassembly from the instrument and apply a voltage of 14V ± 0.1 V via a multimeter (100 mA range) to pins 3/4 and 30/31. The multimeter should show a current of

$$Io = 38 \text{ mA} \pm 5 \text{ mA}$$

4.6.3.3 Checking the DC Voltage

The following DC voltages are to be checked with a digital voltmeter or a µA multimeter against chassis (pin 28/29) - (with lock-in lamp on)

U(V)	TS1	Ts2	Ts3	Ts4
U_C	4.0-4.6	4.2-5.5	11.2-12.2	13.5-14.0
U_B	2.1-2.7	1.0-1.4	4.9-5.5	1.0-1.8
U_E	1.5-2.1	0.4-0.8	4.3-4.9	~0

U(V)	Ts5	Ts6
U_C	12.5-13.5	13.8-14.0
U_B	5.7- 6.7	5.2- 6.2
U_E	5.1- 6.1	4.6- 5.6

4.6.3.4. "Filter"

For this measurement remove the subassembly from the level meter

Apply a voltage of U = 14V ± 0.1V (against chassis, pin 28/29) to pin 30/31; at pin 20/21 apply via a resistor of 27 K Ohm a DC voltage of U- = +17.5V ± 0.1V; at pin 20/21 apply, via a 1.5 -/uF (capacitor), a level (p = -15 dB; R1 = 0 f = 20 KHz ± 40 Hz); at pin 14/15 connect a level meter (high impedance, wideband).

The level meter should show a level of

p = -16dB ± 1 dB

When connected to soldering pin 4 (emitter of Ts 3) the level meter should display a level of:

p = +15dB ± 2dB (Ts4 is blocked during this measurement).

Changing the input level to -28 dB ±1 dB should allow transistor 4 to switch on (this means that the lock-in lamp lights up in the instrument)

100 kHz pole adjustment of the 50 kHz low pass filter. The level oscillator (p= 0dB; $R_1 \approx 0$; f= 100 KHz ± 5 Hz; the DC Voltages $U_{_}$ = + 14V ± 0.1V and $U_{_}$ = + 17.5V ± 0.1V remain connected as before. The level meter (selective high impedance synchronised with the oscillator) is again connected to pin 14/15. Adjust L1 to minimum deflection on the level meter.

nominal value p ≤ - 85 dB

200 KHz pole adjustment of the 50 KHz low pass filter.
With a transmit and receive frequency of f = 200 kHz ±5 Hz, adjust L2 to minimum deflection on the level meter.

nominal value $p \leq -80$ dB

Repeat the 100 KHz pole adjustment

4.6.3.4 "Amplifier"

To test the buffer amplifier operate the subassembly via an adapter, set switch S4 to lock-in position. Set F_1 film scale to f= 1 MHz locked in (that is 25 MHz at the buffer amplifier) and measure with a HF multimeter the input voltage at pin 9/10 and the output voltage at pin 1/2 of the subassembly.

The output voltage should correspond within ± 35 mV to the input voltage (≈ 280mV). The wave form should be a pure undistorted sine wave.

4.6.3.5 Regulating range of R46

Connect the digital voltmeter to pin 12/13 of the subassembly. The potentiometer should produce a voltage of 4.1. to 4.9 V. Now connect the digital voltmeter to C43 of the f_1 oscillator and set switch S4 in position "free running" (not locked in) by means of R46 of subassembly D5277 set the voltage again to + 4.5V ± 50mV.

4.6.4 F_2 Oscillator D5278

The f_2 oscillator **like the f_1 oscillator consists of the** oscillator circuit and a subsequent amplifier. The frequency f_2 **adjusted on the film scale (0 to 100 kHz) corresponds to an oscillator frequency which is higher by 500 kHz;** f_{osc2} (500 to 600 kHz

$$f_{osc2} = f_2 + 500 \text{ kHz} \pm \Delta f$$

The casting of the f_2 oscillator **further contains the buffer** amplifier (D 5280) for the f_3 voltage (synchronisation f_3 **and** the control voltage for the 2nd modulator) and the relay board D5275.

4.6.4.1 Measuring equipment required

1 oscilloscope with divider probe, e.g. oscillaM214
1 frequency counter
1 level meter eg D354 (1.6 MHz)
1 Digital Voltmeter
1 µA multimeter ($R_1 \geq 50$ kOhm/V)
1 oven +10 to +60°C

4.6.4.2 Preparation

To gain access to all measuring points in the oscillator remove all covers of the instrument and fold out the mother board (see section 4.3 of the fault finding procedure) The lower cover of the oscillator must also be removed.

4.6.4.3 Remarks

The f_2 oscillator D5278 is TK-compensated. Should it be necessary to replace a frequency determining component (the new capacitors must definately have the same TK values as the original capacitors) a new TK adjustment is necessary. Thereafter the frequency scale has to be checked. If the value indicated by the film scale no longer corresponds to the oscillator frequency, the film scale is to be readjusted according to section 3.2.1 (maintenance). If this adjustment is insufficient a new film scale has to be made. (preferably return the f_2 oscillator to the works).

4.6.4.4 Current consumption of the f_2 oscillator.
Disconnect the supply voltage U = +14 V ±0.1 V from the Duco C24 of the oscillator and reconnect it via a µA multimeter (30 mA range). The current indicated by the multimeter should be

$$Io = 25 \text{ mA} \pm 5\text{mA}$$

4.6.4.5 DC Voltage
The following voltages are to be checked with a digital voltmeter (or µA multimeter) against the housing of the oscillator (switch S8 in position .0 = AFC off).

Voltage at C24 - U_{C24} = +14V ± 0.1V
Voltage at C25 - U_{C25} = +12.0V ± 0.6V
Voltage at C26 - U_{C26} = + 7.8V ± 50 mA
(if necessary adjust with P3

U(V)	Ts1	Ts2
U_C	11.75-12.25	12.4-13.4
U_B	1.6-2.0	7.2-8.2
U_E	1.0-1.4	6.6-7.6

4.6.4.6 Output voltage

Remove the cover from the bottom of the oscillator. With the voltages U_{C24}, U_{C25} and U_{C26} applied tune the f_2 oscillator to f_2 = 50 KHz (i.e. f osc_2 = 550 KHz). Connect a level meter (75 Ohm/coaxial, f = 550 KHz) to Bu 16 and measure the output voltage of the f_2 oscillator.

Nominal value p = 0 dBm $\pm$ 1 dB

4.6.4.7 Frequency response of the output voltage.

The level meter remains connected to Bu 16. The level, referred to 550 kHz, may vary maximum $\pm$0.5 dB over the entire frequency range of the oscillator 490 to 610 kHz.

4.6.4.8 Wave shape of the output voltage

In addition to the level meter an oscilloscope is to be connected to Bu 16 and the wave shape examined. A pure undistorted sine wave should be indicated.

4.6.4.9 Regulating range of the capacitance diode

Connect a digital voltmeter to connection point "a" of the ceramic soldering strip of the f_2 oscillator. The frequency counter remains connected to Bu 16. A voltage change of 5V $\pm$ 0.1 (at connection point "a" caused by adjusting potentiometer P3 from stop to stop) must produce,at a frequency of approximately 500 kHz, a deviation of at least 1 kHz and, at a frequency of 600 kHz, a change of at least 1.6 KHz.

4.6.4.10 TK adjustment

This adjustment is necessary when frequency determining components are replaced in oscillator D5279.

Remove the f_2 oscillator from the D2007. Set trimmer C2 exactly to its middle position and replace the bottom cover of the oscillator. Tighten the screws firmly. To Bu 16 connect the frequency counter; to connection point "C" of the ceramic soldering

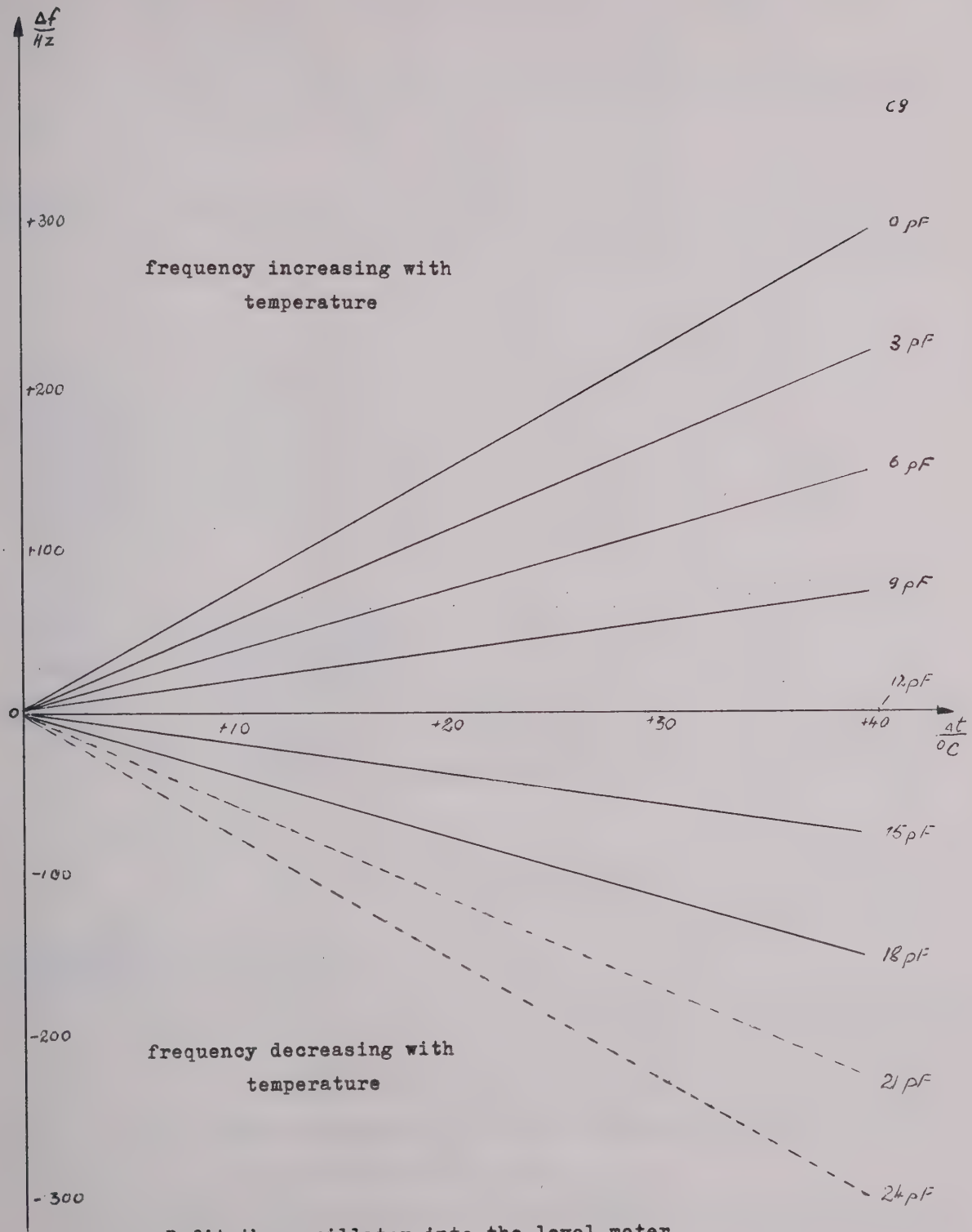
strips apply a DC voltage of $U_{_}$ = +14V ± o.1V; to connection point "a" apply a DC voltage of $U_{_}$ = 7.8V ± 0.05. By means of capacitor C1 adjust the frequency f osc_2 = 550 kHz.

Operate the f_2 oscillator, with the connections indicated above for approx 1 hour at ambient temperature. Thereafter tap the **coupling lightly (to eliminate any tension) and measure** the frequency f_1 at room temperature t_1. Note the frequency.

Now place the f_2 oscillator (without touching the film drive i.e. without shifting the frequency) in an climatic chamber and heat it by approx 40°C to the temperature $f_2 = t_1 + 40°C \approx 60°C$. Operate the oscillator at this temperature for approx 2 hours. After these two hours measure and note the frequency (f_2) and the tempearature (t_2) **and determine the difference between** f_2 and f_1 **and that between** t_2 **and** t_1 **e.g.:**

$$\Delta f = f_2 - f_1 \quad \text{and} \quad \Delta t = t_2 - t_1$$

If the frequency deviation is greater than 60 Hz determine the appropriate trimming capacitor C9 from the following table and solder it into the circuit (TK value of C9-N750)



Refit the oscillator into the level meter

4.6.4.11 Frequency adjustment

The counter remains connected as in 4.6.4.10. Remove the cover of the oscillator. At ambient temperature set the film drive to the right hand stop and set, by means of trimmer C2 of the oscillator, the nominal frequency

$$f_{nom} = 611 \text{ to } 615$$

If the film drive is set to the left hand stop, the counter should show a frequency $f \leqq 484$ KHz

Replace the cover of the oscillator.

4.6.4.12 Correspondence of the scale frequency

The counter remains connected as in 4.6.4.10 and 4.6.4.11 check if the film scale corresponds with the frequency of the oscillator (measured with the counter). The frequency indicated by the counter must be 500 Khz above the frequency indicated by the film scale.

The difference between the value set on the film scale and that indicated on the counter (+500 KHz) should be less than **±100 Hz is this not the case readjust the film scale** according to section 3.2.1 (maintenance). If this adjustment is insufficient the film scale has to be **remade or sent to the factory for remanufacture.**

4.6.4.13 Testing the f_3 - buffer amplifier and relay board.

Current consumption and DC voltage

Remove the supply voltage from **part of the buffer amplifier at C45 and reconnect it via a /uA multimeter (10 mA range). The /uA multimeter must indicate a current of**

$$Io = 2.5 \text{ mA} \pm 0.5 \text{ mA}$$

Check the following voltages on Ts7 and Ts8

U(V)	Ts 7	Ts 8
U_C	13.0-14. 0	11.6-12.6
U_B	6.1-7.1	4.4- 5.4
U_E	5.5-6.5	3.8- 4.8

Reconnect the power supply directly to C45,

Remove the power supply for the second part of the current amplifier from C46 and reconnect it via a µA multizet.

Press the calibration button. The µA multimeter should now show a current of

$$Io = 2.5 \text{ mA} \pm 0.5 \text{ mA}$$

With the calibration button depressed, check the DC voltages on Ts 5 and Ts 6.

U(V)	Ts 5	Ts 6
U_C	13.0-14. 0	11.6-12.6
U_B	6.1- 7.1.	4.4-5.4
U_E	5.5-6.5	3.8- 4.8

Connect a level meter to Bu 14 (f = 21.6 MHz p = 0 dBm, Z = 75 Ohm/coaxial) At measuring point 2 of the mother board connect a frequency counter (via the amplifier in the oscilloscope). **The level meter must indicate a level of p = 0 dBm at f = 21.6 MHz, with a setting f = 0 kHz at the f_2 oscillator. The frequency meter must indicate a frequency of 25 MHz with a setting of f = 1 MHz on the f_1 oscillator.**

If now the calibration button is pressed the frequency indicated on the frequency counter must be 21.6 MHz.

4.6.5 f_3 oscillator D5281

This subassembly consists of a crystal oscillator, a regulated free running oscillator and a modulator. This modulator derives one of the regulating voltages from the signals of the oscillators. The regulated oscillator frequency is applied as control voltage to modulator 2 of the D2007.

Testing of this subassembly is not carried out in the level meter D2007 (via an adapter).

4.6.5.1 Measuring Equipment and Accessories Required

1 25 MHz level meter 75 Ohm coaxial e.g. D2072

1 25 MHz level oscillator 75 Ohm coaxial e.g. W2072

1 oscilloscope with sampling plug in eg Siemens Oscillar M214

1 Frequency Counter

1 Digital Voltmeter

1 HF-Multimeter

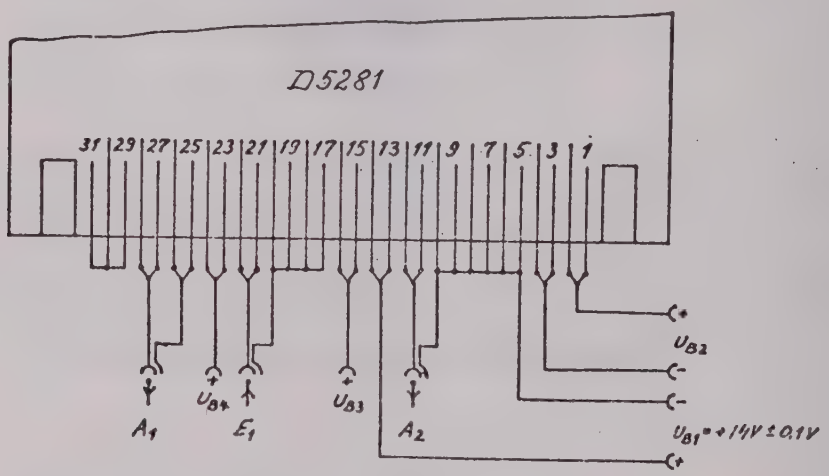
1 µA Multimeter $R_i \geq 50$ kOhm/V

1 DC Power Supply, + 14 V Stabilised

1 DC Power Supply, + 3 to 12V stabilised

1 Ceramic capacitor, C = 10,000 pf ± 10%

4.6.5.2 Current consumption



Connect via a µA multimeter (100 mA range) a DC Voltage of 14 V ±0.1 V to U_{B1} and U_{B3} and measure the current drawn by the subassembly.

nominal value Io = 30mA ± 3mA

4.6.5.3 Checking the DC voltages

The following voltages are to be checked with a digital voltmeter or µA multimeter against chassis (pin 17...20)

U(V)	Ts1	Ts3	Ts4	Ts5	Ts6
U_C	12.7-13.7	13.0-14.0	13.5-14.0	12.5-13.9	5.4-6.4
U_B	2.3- 2.9	5.0- 5.8	5.6-6.6	6.3- 7.3	2.4-3.0
U_E	1.7-2.2	4.4- 5.2	5.0-6.0	5.7-6.7	1.8-2.4

U(V)	Ts 7
U_C	11.7-13.7
U_B	10.8-11.8
U_E	10.2-11.2

4.6.5.4 Crystal Oscillator

Leave the subassembly connected to the DC supply via U_{B1} and U_{B3}. (+14 V ±0.1 V) and short circuit the coil L2.

Adjusting the Tuned circuit.

Remove the cover from crystal 1 and the transformer U_1. Set trimmer C3 in mid position. Insert between soldering pin 7 (connection 6 of U1) and the upper connection of the crystal (R2, 3, 6 - crystal) a ceramic capacitor (10,000 pf) with as short leads as possible. Replace the cover and connect to pins 8 and 9 a frequency counter via a divider probe. With the transformer adjust the frequency to

$$f = 22.1 \text{ MHz} \pm 1 \text{ KHz}$$

and adjust the oscillator frequency with trimmer C3 to

$$f = 22.1 \text{ MHz} \pm 5 \text{ Hz}.$$

Should the range of C3 be insufficient alter C2 or adjust U1 a little.

4.6.5.5 Free running oscillator:

At connection U_{B1} apply a DC voltage of +14V ± o.1V. At connection U_{B2} apply 7.8 V ±50 mV. Connect a frequency counter and a level meter to "A1" p = 0 dBm/75 coaxial/21.6 MHz. Remove cover over L2.

Output level:

The output level measured by the level meter should be

p= 0 dBm ± 1 dB

(adjust if necessary with R40)

Frequency adjustment:

Set the indication on the frequency counter by means of trimmer C39 to

f = 21.600 MHz ±2 kHz

(with U_{B2} = 7.8 V ± 50 mV, if necessary, further adjustment With C38)

When the voltage U_{B2} is lowered to 4V the frequency must drop to

$f_{4V} \leqq$ 21.5 MHz

If the voltage U_{B2} is varied from 3.0 to 12V the maximum permitted output level variation at "A1" is ±0.6 dB

$$\Delta p \leq \pm 0.6 \text{ dB}$$

Wave shape of the output voltage

Connect an oscilloscope with sampling plug-in to output "A1" and examine the wave shape of the output signal at U_{B2}= 4V

A pure undistorted sine wave must be present.

4.6.5.6 Modulator

Checking the output level

Check (with a digital voltmeter) the supply voltages U_{B1} = + 14V ± 0.1V and U_{B2} = +14V ± 50mV

With a HF- multimeter (200 mV -range) measure the output voltage at "A2" (against chassis)

$$U\sim = 155mV \pm 5mV$$

If the voltage is to large (small) increase **(reduce)** R24

4.6.6 Phase modulator/Search Oscillator D5282

In this subassembly the regulating voltage for the free **running f3 oscillator is derived from the voltages of the f2 and the f3 oscillator (500 to 600 kHz).**

During failure of one of these voltages i.e. during a fault in the regulating loop of the f3 oscillator a relay is switched **via transistors Ts7 and Ts8 of the subassembly and thereby lamp** Lp5 (f2 disturbed) is switched on.

4.6.6.1 Measuring Equipment Required

1 Level meter e.g. D354 **(1.6 MHz)**
1 Level Oscillator e.g. W231 **(1.6 MHz)**
1 Level Meter D2007
1 Oscilloscope e.g. Siemens OscillarM214
1 µA multimeter ($R_i \geq 50$ kOhm/V)

4.6.6.2 Current consumption

The current drawn by the subassembly measured with a µA multimeter in the 100 mA range, at pin 13/14 should be

$$Io = 34 mA \pm 3 mA$$

4.6.6.3 Checking the DC Voltages

The following voltages are to be checked with a digital voltmeter or /uA multimeter against chassis (pin 7..... 10)

U(V)	Ts1	Ts2	Ts3	Ts4	Ts5
U_C	8,0-9.6	12.2-13.8	5.7-6.9	11.8-13.8	6.4-7.4
U_B	1.4-2.0	8.0-9.6	2.0-2.4	5.8-6.8	3.0-3.6
U_E	0.8-1.4	7.4-9.0	1.4-1.8	5.2-6.2	2.4-3.0

U(V)	Ts6	Ts7	Ts8
U_C	9.3-11.3	12.3-13.3	13.5-14.0
U_B	3.0-4.0	~ 0	12.8-13.8
U_E	2.4-3.4	~ 0	0

4.6.6.4 Search oscillator

Remove the "f_3-oscillator"from the motherboard assembly and connect an oscilloscope to the transistor Ts 5 of subassembly D5282.

The oscilloscope must show the voltage specified in the circuit diagram. The f_2 disturbed lamp "Lp 5" must light up.

4.6.6.5 Amplifier

Reconnect the f_3 oscillator to the level meter. Thereupon the f_2 disturbed lamp "Lp 5" must go out.

With a level meter (e.g. D354, coaxial, high impedance, wide band) measure the level at the emitter of transistor Ts 4

nominal value: p = +10 dB $\pm$3 dB.

4.6.6.6 Checking the disturbed indication:

Connect a level oscillator to Bu15 of the D2007 (e.g. W231, coaxial, Z = 75 Ohm)

Test the disturbed indication in accordance with the following table:

Level oscillator at Bu 15		D2007	
f	p	Relay	Lamp "Lp5"
550 kHz	-20 dB	pulled in	on
550 kHz	-11 dB	dropped **out**	off
>680 kHz	- 9 dB	pulled in	on
<420 kHz	- 9 dB	pulled in	on
750 kHz	- 9 dB	pulled in	on
<680 kHz	- 9 dB	dropped **out**	off
350 kHz	- 9 dB	pulled in	on
>420 kHz	- 9 dB	dropped **out**	off

The frequency limits in which the lamp will light or not light up can be adjusted with C39 in subassembly D5281.

4.6.7 Measuring Circuit D5283

The measuring circuit contains the balanced and coaxial input to the level meter. The input divider and the preamplifier.

4.6.7.1 Measuring Equipment and Accessories **Required**

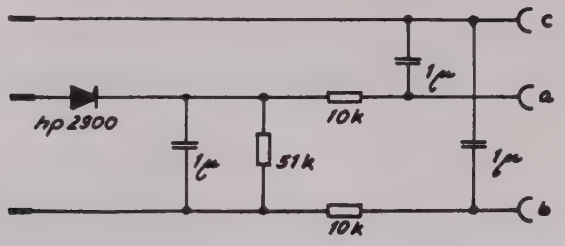
1 Level Meter D2021 **(25 MHz)**
1 Level oscillator W2021 **(25 MHz)**
2 Frequency G2021 **(25 MHz)**
1 Level Meter D2007
1 Level Oscillator W2007
1 Level difference meter D2003
1 Digital Voltmeter
1 Adjustable low pass filter stop band attenuation a_s >80 dB
1 N - X switch - B2003
1 Z - Branching Unit - B2017
2 Precision attenuators eg. D120
1 probe B2015 - B2050 or **capacitive divider a = 20 dB**
1 impedance bridge **R2018**
1 **Reflectometer bridge** R267

2 µA multimeter

1 DC power supply 14V stabilised

1 Test adapter (drive) - D5283-

1 Rectifier circuit



1 Resistor 5.6 Ohm ± 5%

2 Resistor 62 Ohm ± 2%, **but matched to within 0.1 %**

1 Resistor 68 Ohm ± 5%

1 Resistor 75 Ohm ± 1%

1 Resistor 124 Ohm ± 0.02%

1 Resistor 126 Ohm ± 0.02%

1 Resistor 135 Ohm ± 0.02%

1 Resistor 150 Ohm ± 0.02%

1 Resistor 10 KOhm ± 5%

1 Resistor 10.1 KOhm ± 0.02%

4.6.7.2 Drive to the Measuring Circuit

4.6.7.2.1 Switching of the attenuator and amplifier stages

a) for instruments with level matrix - D5303-A701

Switch S1	+14 at pin of 21 pole connector	≙ low distortion ...dB/dBm	relay pulls in	amplification V(dB)	attenuation. (dB)
1	6 and 12/13	-10/0	Q and L	0	40
2	6 and 12/13	-20/-10	Q and L	0	40
3	6 and 12/13	-30/-20	Q and L	0	40
4	6 and 12/13	-40/-30	Q and L	0	40
5	5 and 12/13	-50/-40	R and L	10	40
6	6 and 14/15	-60/-50	Q and K,M	0	20
7	5 and 14/15	-70/-60	R and K,M	10	20
8	6 and 18/19	-80/-70	Q and J,N	0	0
9	5 and 18/19	-90/-80	R and J,N	10	0
10	18/19	-100/-90	J,N	20	0
11	18/19	-110/-100	J,N	20	0

b) for equipment with level matrix -D5303-B701

S1 Position	+14V at pin of 21 pole connector	≙ ....dB/dBm low distortion	Relays pulls in	V(dB) Amplification	attenuation
1	6 and 12/13	-10/0	Q and L	0	40
2	6 and 12/13	-20/-10	Q and L	0	40
3	6 and 12/13	-30/-20	Q and L	0	40
4	6 and 12/13	-40/-30	Q and L	0	40
5	5 and 12/13	-50/-40	R and L	10	40
6	6 and 14/15	-60/-50	Q and K,M	0	20
7	5 and 14/15	-70/-60	R and K,M	10	20
8	5 and 14/15	-80/-70	R and K,M	10	20
9	6 and 18/19	-90/-80	Q and J,N	0	0
10	5 and 18/19	-100/-90	R and J,N	10	0
11	18/19	-110/-100	J,N	20	0

4.6.7.2.2 Switching the impedance values

S2 Position	+14V at pin of 21 pole connector	≙ Z value	Relay Pulls in
1	-	∞coaxial	-
2	21 and -	75 Ohm coaxial	A
3	1 and 20	124 Ohm balanced	D and H
4	- and 20	∞ balanced	H
5	2 and 20	135 Ohm,balanced	E and H
6	- and 20	∞ ,balanced	and H
7	3 and 20	150 Ohm,balanced	F and H
8	- and 20	∞ ,balanced x)	H
9	4 and 20	124 Ohm,balanced	B,C,G, & H

x) to 10 MHz

4.6.7.2.3 Switching - Calibration/Measuring

Push Button T1	+14V at pin...of 21 pole connector	≙ operating mode	relay pulls in
pressed	6 and 16/17	calibrate	Q and P
released	corresponding 4.6.7.2.1./2.	measure	-

4.6.7.3 Testing the Preamplifier

4.6.7.3.1 Current consumption **(measured without drive) and DC Voltages**

The subassembly is connected only from 10/11 of 21 pin connector via µA multimeter (100mA range) to the " + " pole and from pin 7/8 to the "-" pole of the DC power supply (U- = + 14V ± 0.1V) The current consumption of the subassembly should be

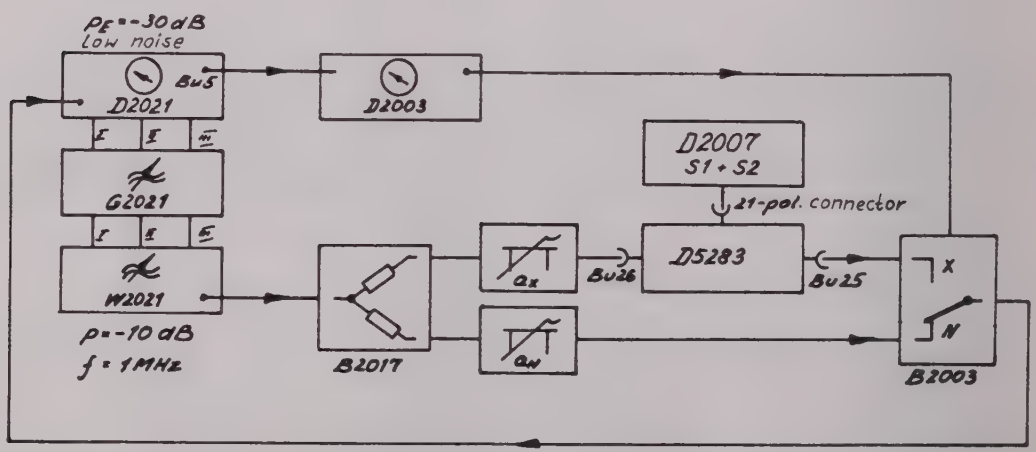
$$Io = 40\ mA \pm 5mA$$

Check the following voltages using a digital voltmeter or µA multimeter against chassis (pin 7/8)

U(V)	Ts1	Ts2	Ts3	Ts4	Ts5
U_C	12.6-14.0	5.9-7.1	7.3-8.9	11.0-13.0	6.9-7.9
U_B	8.0-9.0	3.5-4.1	2.1-2.7	7.5-8.5	2.3-2.9
U_E	7.4-8.4	2.9-3.5	1.5-2.1	6.9-7.9	1.7-2.3

4.6.7.3.2 Adjusting the amplifier stages

Attention! The **settings shown in brackets apply to the** instruments with level matrix -D5303-B701.



To calibrate the measuring set-up replace subassembly -D5283- with a short 75 Ohm coaxial cable. With the attenuator in **the** N path adjust the level difference meter to "0". Both attenuators should have an attenuation of approx a = 30 dB. **Adjustment at V = 0 dB**

Set level meter D2007 as follows:

Switch S1: position 8 (9)

Switch S2: position (any position)

Switch S6: position (low distortion)

In addition apply a DC voltage of +14 V ±0.1 V to pin 16/17 of the measuring circuit.

Reinsert subassembly -D5283- into the measuring set up.

The level difference indicated by the level difference meter should be less than ±0.1 dB. If this is not the case adjust R66 accordingly.

$$\Delta p \leq \pm 0.1 \text{ dB}$$

Now adjust the N path so that the indication on the level difference meter is exactly $\Delta p = 0$

Adjustment at V = 10 dB

Reduce the attenuation in the N path (a_N) by 10 dB. Set switch S1 to position 9(10). All other controls remain as for adjustment at V = 0 dB, the DC voltage also remains on pin 16/17.

By means of potentiometer R51 (taking into consideration the divider error of the attenuator in the N path) adjust the indication on the level difference meter to $\Delta p \leq \pm 0.02$ dB.

Adjustment at V = 20 dB

Reduce the attenuation in the N path (a_N) again by 10 dB. Set switch S1 to position 10(11). All other controls remain as before, also the DC voltage remains on pin 16/17.

By means of potentiometer R61 (taking into consideration the divider error of the attenuator in the N patn) adjust the indication on the level difference meter to $\Delta p \leq \pm 0.02$ dB.

4.6.7.3.3 Frequency Response of the Amplifier stages

The test set up of 4.6.7.3.2 remains intact.

Again check the frequency response of the test set up short circuited i.e. without the subassembly -D5283- (With a = 30 dB; repeated at a = 20 dB and a = 10 dB on the attenuator) in the frequency range 6 kHz to 18.6 MHz.

Reference point is f = 1 MHz

Frequency Response at V = 0 dB

Insert the subassembly into the test set up. Set the level meter as previously in 4.6.7.3.2 (V = 0 dB). Apply a DC voltage of +14 V ±0.1 V to pin 16/17.

At f = 1 MHz and with the two attenuators (in N and X paths) set to approx. 30 dB adjust the indication on the level difference meter to $\Delta p = 0$ by means of the attenuator in the N path and the level difference meter itself.

At f = 16 MHz adjust coil L6 of subassembly -D5283- to produce the indication p = 0 dB on the level difference meter again, taking into consideration the frequency response of the test set up.

Now check the frequency response of the subassembly (V = 0 dB) in the frequency range 6 kHz to 18,6 MHz referred to f = 1 MHz and take into consideration the frequency response of the test set up.

nominal value $\Delta p \leq \pm 0.05$ dB

Frequency Response at V = 10 dB.

Set the level meter as previously in 4.6.7.3.2 (V = 10 dB) as well as the DC voltage +14 V ±0.1 V at pin 16/17.

Reduce the attenuation in the N path: a = 10 dB less than during the previous measurement (V = 0 dB)

($a_N \approx 20$ dB)

At f = 1 MHz adjust the indication an the level difference meter $\Delta p = 0$ dB

At f = 16 MHz adjust coil L7 of subassembly D5283 to produce the indication p = 0 dB on the level difference meter again (taking into consideration the frequency response of the test set up).

Now check the frequency response of the subassembly (V = 10 dB) in the frequency range 6 kHz to 18.6 MHz referred to f = 1 MHz and take into consideration the frequency response of the test set up.

nominal value $\Delta p \leq \pm 0.05$ dB

Frequency Response at V = 20 dB

Adjust the level meter as in 4.6.7.3.2 (V = 20 dB). Also apply a DC voltage of +14V ± 0.1V at pin 16/17.

Attenuator in N-branch: a = 10 dB less than during the previous measurements (V = 10 dB)

(aN $\approx$ 10 dB)

Adjust the indication of the level difference meter to Δp = 0dB at f = 1 MHz

At f = 10 MHz adjust coil L8 of subassembly -D5283. To **produce the indication Δp = 0 dB on the level difference meter again, taking into consideration the frequency** response of the test set up.

Now check the frequency response of the subassembly (V = 20 dB) in the range 6 KHz to 18.6 MHz referred to f = 1 MHz and **take into consideration the frequency** response of the test set up.

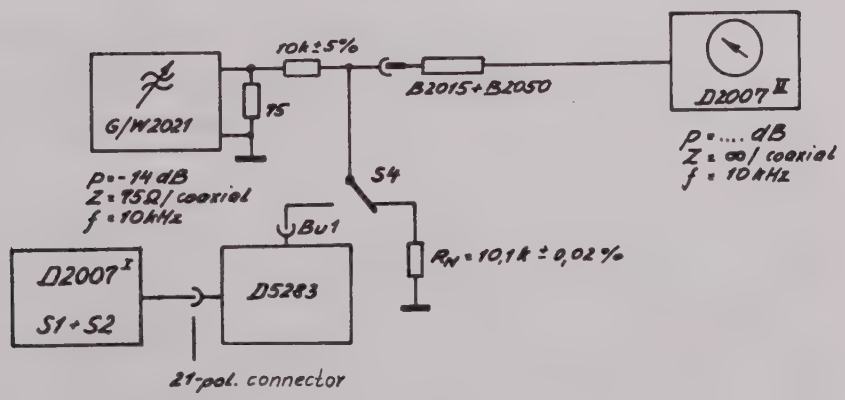
nominal value $\Delta p \leq \pm$ 0.05 dB

4.6.7.3 Testing the input divider

Close the trimmers C4 and C9 to 3/4, trimmers C10 and C12 to half way and trimmers C15 and C16 to 1/4 way.

The order of measurement must definitely be maintained.

4.6.7.3.1 Adjusting the basic attenuation at f = 10 KHz

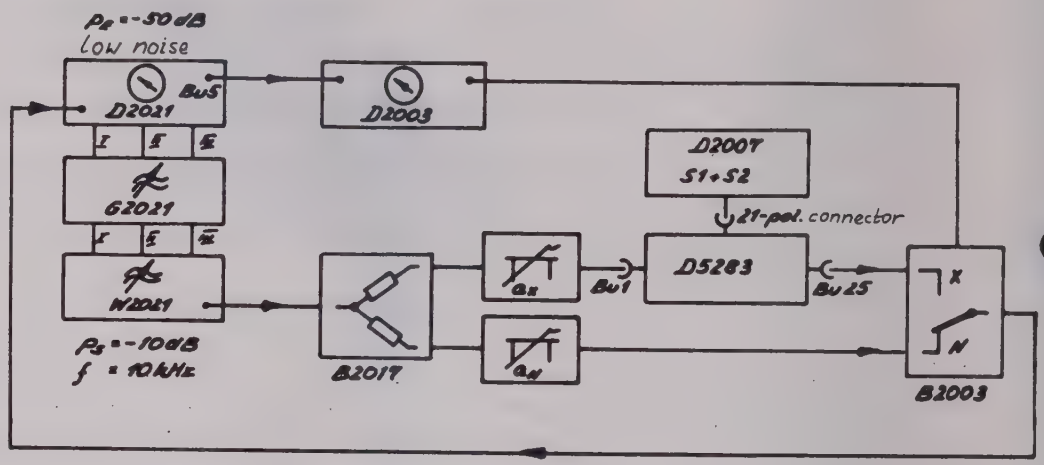


In the measuring circuit control set switch S1 to position 9 (10), the switch S2 to position 1 and the switch S6 to position 2 (low noise).

Now, with standard resistor R_N switched into the circuit, adjust the expanded scale indication exactly to 0 (tune level meter to transmit frequency).

By means of S4 connect the **unit under test and by adjusting** R37 (in D5283) set the indication again **exactly to 0.**

4.6.7.3.2 Checking the attenuator steps f = 10 KHz



With the switches in the following positions set the indication on the level difference meter **exactly to** 0 dB (Δ p)

Switch S1 position 4 (4)
Switch S2 position 2
Switch S6 position 2 (low distortion)
Attenuation a_N = 50 dB
Attenuation a_X = 10 dB

Ther check the attenuator steps according to the following table (take into consideration divider error Δa_X)

D2007 S1 Position	D2007 S2 Position	Precision Attenuator a_N(dB)	Precision Attenuator a_X(dB)	Indication on level difference meter: Δ p (dB)
5 (5)	2	50	20	± 0.03
6 (6)	2	50	30	± 0.03
7 (7)	2	50	40	± 0.03
8 (9)	2	50	50	± 0.03
9 (10)	2	50	60	± 0.03
10 (11)	2	50	70	± 0.03

4.6.7.3.3 Adjustment 1 of the attenuator steps f = 16 MHz

The test set up remains as in 4.6.7.3.2. With the following switch settings adjust (with f = 16 MHz) the indication on the level difference meter to exactly 0 dB(Δp)

Switch S1: position 8 (9)
Switch S2: position 2
Switch S6: position 2 (low noise)
Attenuation a_N = 50 dB
Attenuation a_X = 50 dB

Then carry out the adjustment, taking into consideration the divider error of the attenuator in the X-branch (Δa_X), at f = 16 MHz in accordance with the following table.

D2007 S1 Position	D2007 S2 Position	Precision Attenuator a_N(dB)	Precision Attenuator a_X(dB)	Adjust	Indication of Level difference meter Δp (dB)
6(6)	2	50	30	C12	± 0,02
4(4)	2	50	10	C15	± 0,02

4.6.7.3.4 Adjustment 1, Input capacitance - coaxial input -

Using impedance bridge R2018 adjust, the input capacitance of subassembly -D5283- at f = 500 kHz in accordance with the following table (take into consideration capacitance of the measuring leads).

D2007 S1 Position	D2007 S2 Position	Trimmer adjust	nominal value in pf
4(4)	1	C16	60 ± 1
6(6)	1	C10	60 ± 1
8(9)	1	C 9	60 ± 1

4.6.7.3.5 Adjustment 1, reflection coefficient - coaxial input

Using the reflectometer bridge R267 adjust the measuring circuit for maximum reflection coefficient at f = 16 MHz as follows:

D2007: Switch S1 in position 4 (4)
Switch S2 in position 2
Switch S6 in position 2

The adjustment is made alternately with L1 and L2

nominal value $a_r \geq 35$ dB

In accordance with the following table check the reflection coefficient in the frequency range 1 MHz to 18.6 MHz

D2007 S1 Position	D2007 S2 Position	nominal value
4(4)	2	$a_r \geq 35$ dB
6(6)	2	$a_r \geq 35$ dB
8(9)	2	$a_r \geq 35$ dB

4.6.7.3.6 Adjustment 2 **of the frequency response of the attenuator steps**

Test set up as in 4.6.7.3.2

In accordance with the following table adjust the frequency response of the attenuator steps at f = 16 MHz, referred to f = 100 KHz and taking into consideration the frequency response of the test set up.

D2007		Precision Attenuator		Adjust	Indication of level diff. meter Δp(dB)
S1 Position	S2 Position	a_N(dB)	a_X(dB)		
8(9)	2	50	50	R18	$\pm$ 0,02
6(6)	2	50	30	C12	$\pm$ 0,02
4(4)	2	50	10	C15	$\pm$ 0,02

4.6.7.3.7 Adjustment 2: Input Capacitance

Repeat the measurement and adjustment in 4.6.7.3.4

4.6.7.3.8 Adjustment 3, frequency response of the attenuator steps.

Repeat the measurement and adjustment of 4.6.7.3.6

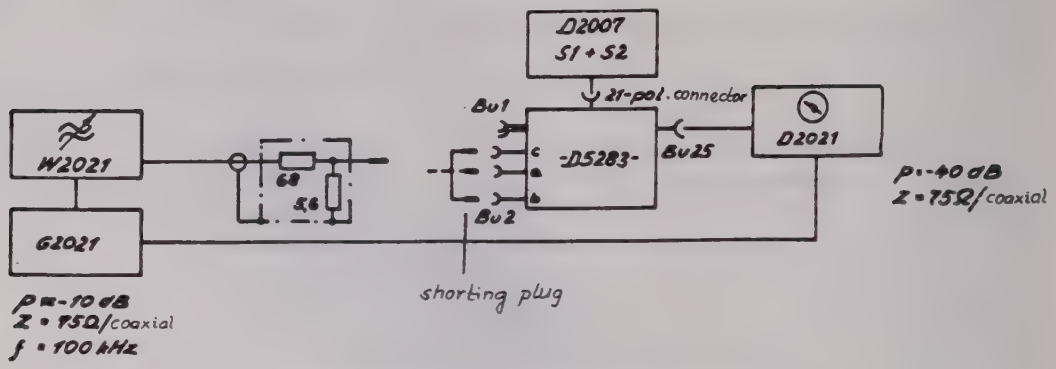
4.6.7.3.9 Checking the frequency response

In accordance with the following table check the frequency **response referred to 1 MHz of the measuring circuit in the frequency range 6 kHz to 18.6 MHz using the test set up described in 4.6.7.3.2 taking into consideration the frequency response of the test set up.**

D2007		Precision Attenuator		Indication at level diff. meter.		
S1 Position	S2 Position	a_N(dB)	a_X(dB)	6kHz-12MHz Δp(dB)	12-15MHz Δp(dB)	15-18,6MHz Δ p(dB)
4(4)	2	50	10	$\pm$ 0.06	$\pm$ 0.1	$\pm$ 0.15
5(5)	2	50	20	$\pm$ 0.06	$\pm$ 0.1	$\pm$ 0.15
6(6)	2	50	30	$\pm$ 0.06	$\pm$ 0.1	$\pm$ 0.15
7(7)	2	50	40	$\pm$ 0.06	$\pm$ 0.1	$\pm$ 0.15
8(9)	2	50	50	$\pm$ 0.06	$\pm$ 0.1	$\pm$ 0.15
9(10)	2	50	60	$\pm$ 0.06	$\pm$ 0.1	$\pm$ 0.15
10(11)	2	50	70	$\pm$ 0.06	$\pm$ 0.1	$\pm$ 0.15

4.6.7.4 Testing the balanced input

4.6.7.4.1 Checking the transformation ratio



Connect the oscillator via a matching circuit (68 Ohm/5.6 Ohm) to connector "Bu 1 " of the measuring circuit. At the level meter D2007 set switch S1 in position 8 (9); switch S2 in position 1; switch S6 in position 2 and terminate connector "Bu 1" externally with 126 Ohm ± 0.2%.

Now adjust the transmit level so that the level meter D2021 expanded scale) shows exactly - 40 dB.

Input 124 Ohm - 30 KHz to 10 MHz

Set switch "S1" on the level meter D2007 to position 9(10) and switch "S2" to position 9 and remove the 126 Ohm termination. Connect the level oscillator, without changing the level via the matching circuit and link to connector "Bu 2" of the measuring circuit.

A level of p = - 40 dB ± 0.05 dB should be indicated by the level meter.

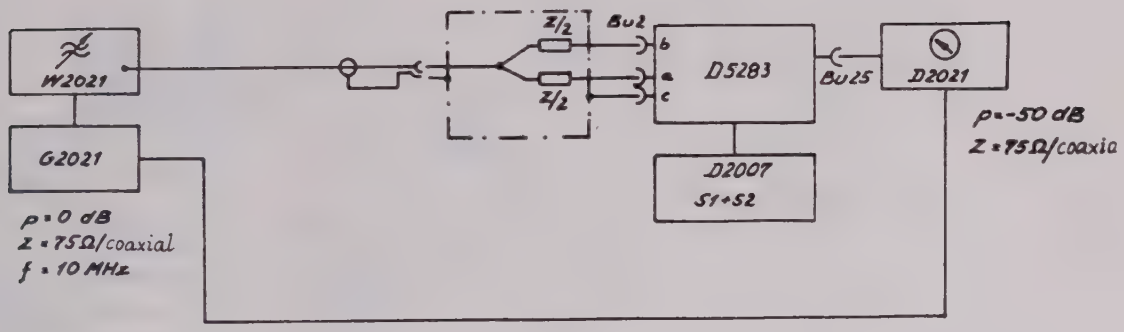
Input 124 Ohm - 6 Khz to 2.2 MHz

Set switch "S1" on the level meter D2007 to position 9 (10) and switch "S2" to position 3. The level meter remains connected to the measuring circuit as previously. The level meter should indicate a level of

$$p = -40 \text{ dB} \pm 0.05 \text{ dB}$$

4.6.7.4.2 Checking the unbalance attenuation

Adjusting the input 124 Ohm - 30 KHz to 10 MHz



Set switch "S1" on the level meter D2007 to position 9 (10), switch "S2" to position 9 and switch "S6" to position 2. Adjust coils L4 and L5 to maximise unbalance attenuation of the measuring circuit.

The level meter D2021 should show a level of $p \leq -40$ dB.

Now check the unbalance attenuation range in the frequency range 30 KHz to 10 MHz. The indication on the level meter must remain less than -40 dB. This corresponds to a unbalance attenuation of

$$a_s \leq 40 \text{ dB}$$

Checking the input 124 Ohm - 6 **kHz** to 2.2 MHz.

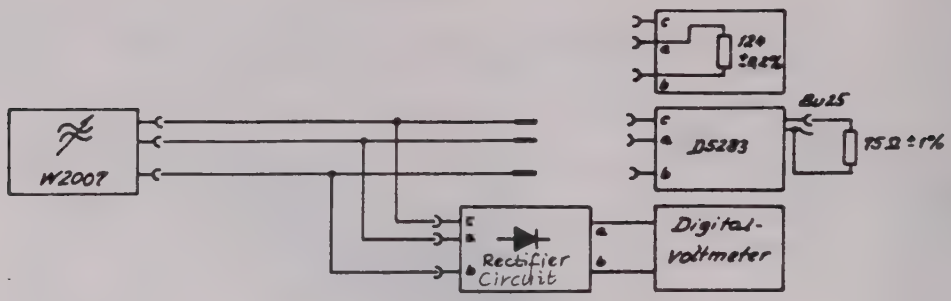
The test set up remains as before **except that switch S2 on the level** meter D2007 is set to position 3. Now measure the unbalance attenuation in the frequency range 6 KHz to 2.200 **MHz.**

The indication on the level meter D2021 must remain less than - 40 dB

$$a_s \geq 40 \text{ dB}$$

4.6.7.4.3 Checking the Frequency Response

Test Set up:



Firstly determine the frequency response of the test set up. To do this, set the level oscillator to Z = 124 Ohm **6 kHz to 2,2 MHz; for the frequency range 30 kHz to 1 MHz;** for the range 1 to 10 MHz to Z = 124 Ohms -30 kHz to 10 MHz

The level oscillator (Z = 124 Ohm 30 KHz to 10 MHz) must **now** be terminated with 124 Ohm (see test set up). Adjust **the transmit level so that, at f = 1 MHz, the indication on the** digital voltmeter is U - = 720 mV

Frequency response - 124 Ohm -30 KHz to 10 MHz; Adjustment of L3

In place of the 124 Ohm termination connect the **measuring circuit** (level meter S1 = position 8(9), S2 = Position 9, S6 = position 2) **and at f = 10 MHz adjust L3 in the measuring circuit to produce** the same value **as previously measured with the digital voltmeter** at f = 10 MHz.

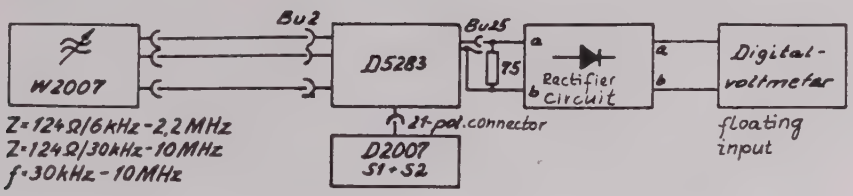
Now check the frequency response in the range 30 KHz to 10 MHz taking into consideration the frequency the frequency response of the test set up. (change impedance **range on the level oscillator** W2007)

Referred to the value at f = 1 MHz the maximum permitted deviation is

$$\Delta U = \pm 10 \text{ mV}$$

This corresponds to a maximum level difference $\Delta p = \pm 0.1$ dB

Frequency response - 124 Ohm, 30 KHz to 10 MHz, adjustment of C4



During this test the previously determined frequency response of the test set has to be taken into consideration:

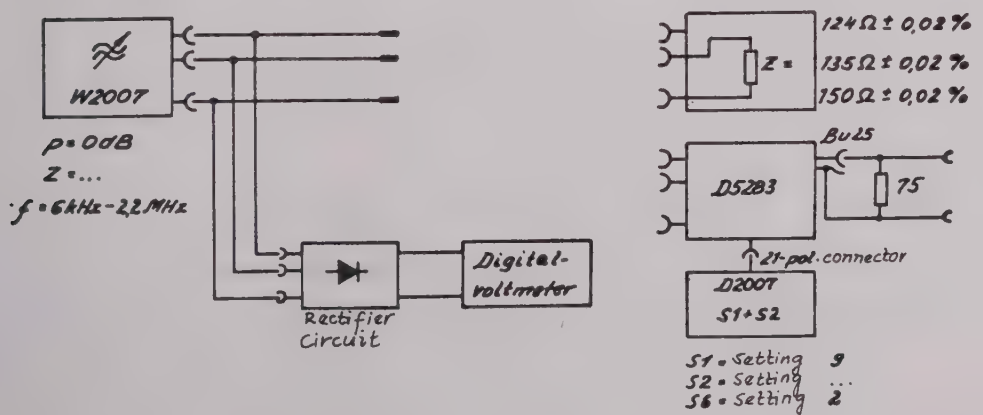
Drive: Switch S1 = position 9 (10)
Switch S2 = position 9
Switch S6 = position 2

At f = 10 MHz adjust trimmer C4 of the measuring circuit to **the value that was shown on the digital voltmeter during measurement of the frequency response at f = 10 MHz of the test set up.**

Now check the frequency response in the range 30 KHz to 10 MHz again taking into consideration the frequency response of the test set up. (change impedance **range on the level oscillator** W2007).

The maximum permitted deviation referred to the value
f = 1 MHz is $\Delta U = \pm 10$ mV
This corresponds to a maximum level difference of
$\Delta p = \pm 0.1$ dB

Frequency response - 124, 135, 150 Ohm; 6 kHz - 2.2 MHz



The frequency response in the range 6 kHz to 2.2 MHz of the test set is to be determined at the impedances Z = 124, 135 and 150 Ohm.

To do this terminate the level oscillator with Z (see test set up) and adjust the transmit level so that at f = 1 MHz, the digital voltmeter shows a voltage of U - = 720 mV.

Now connect the rectifier circuit and the digital voltmeter (as for the measurement of the frequency response to 10 MHz) to the measuring circuit (Bu 25) and check the frequency response in the range 6 KHz to 2.2 MHz at the different impedance values taking into consideration the frequency response of the test set up at the respective impedance values.

W2007 Z=.... Ohm	W2007 S2 switch Position
124	3
135	5
150	7

Permissible deviation:

In the range 10 KHz to 1.6 MHz $\Delta U = \pm$ 6mV $\hat{=} \Delta p = \pm$ 0.06 dB

In the **ranges** 6 KHz to 10 MHz and

1.6 MHz to 2.2 MHz $\Delta U = \pm$ 12mV $\hat{=} \Delta p \pm$ 0.12 dB

referred to the value at 1 MHz

If necessary adjustments can be made with C2

4.6.7.4.4 Check the Z values at f = 1 MHz

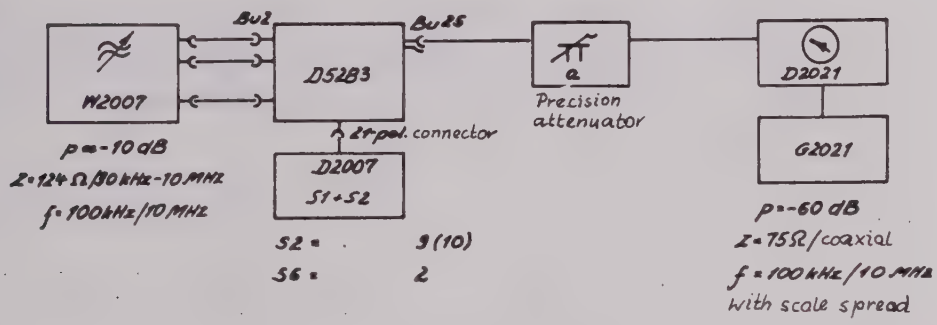
The test set up corresponds to that used during the frequency response measurement i.e. rectifier and digital voltmeter connected directly to the level oscillator output. Terminate the level meter at Z = 124, 135 and 150 Ohm with Z. Adjust the transmit level so that the digital voltmeter shows exactly 720 mV.

Now connect the measuring circuit to the level oscillator, connect the rectifier circuit and the digital voltmeter to Bu 25 **of the measuring circuit with a 75 Ohm termination. The measuring circuit is driven differently according to the corresponding Z Values.**

The maximum permissable deviation - measurement without/ measurement with the measuring circuit is

$$\pm 5 \text{ mV} \mathrel{\hat{=}} \pm 0.05 \text{ dB}$$

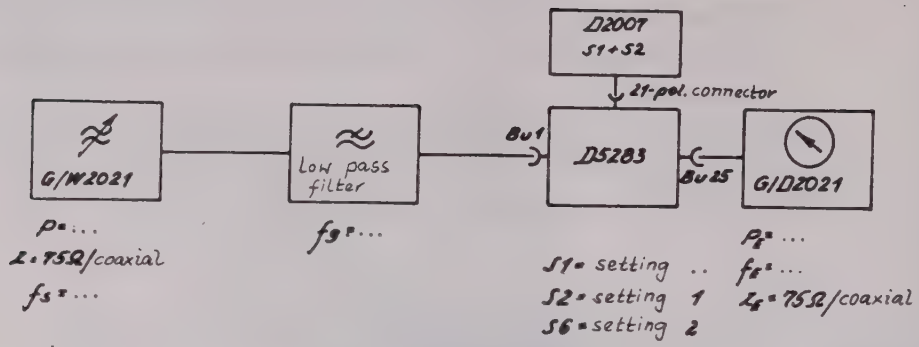
4.6.7.4.5 Checking the level steps at f = 100 KHz and 10 MHz



In accordance with the following table check the level steps of the measuring circuits.

Transmit level	Precision Attenuator	Switch S1 position	Level meter D2021 100 kHz	10 MHz
~ -10	0	4 (4)	**Zero indication on meter**	
~ -10	10	5 (5)	-60 ± 0,03	-60 ± 0,1
~ -10	20	6 (6)	-60 ± 0,03	-60 ± 0,1
~ -10	30	7 (7)	-60 ± 0,03	-60 ± 0,1
~ -10	40	8 (9)	-60 ± 0,03	-60 ± 0,1
~ -10	50	9 (10)	-60 ± 0,03	-60 ± 0,1
~ -10	60	10 (11)	-60 ± 0,03	-60 ± 0,1

4.6.7.5 Measuring the attenuation distortion



Check the attenuation distortion of the subassembly in accordance with the following table (increase the sensitivity of the level meter by 50 dB **referred to the fundamental.**)

P_S ... dB	f_S ...MHz	f_G ... MHz	Switch S1 position	f_E ... MHz	p_E ...dB
~-30	0.05	~0.07	8(9)	0.05	-30
~-30	0.05	~0.07	8(9)	0.1	≤ -100
~-30	0.05	~0.07	8(9)	0.15	≤ -100
~-40	0.05	~0.07	9(10)	0.05	- 30
~-40	0.05	~0.07	9(10)	0.1	≤ -100
~-40	0.05	~0.07	9(10)	0.15	≤ -100
~-50	0.05	~0.07	10(11)	0.05	- 30
~-50	0.05	~0.07	10(11)	0.1	≤ -100
~-50	0.05	~0.07	10(11)	0.15	≤ -100
~-30	1.0	~1.5	8(9)	1.0	- 30
~-30	1.0	~1.5	8(9)	2.0	≤ -100
~-30	1.0	~1.5	8(9)	3.0	≤ -100
~-40	1.0	~1.5	9(10)	1.0	- 30
~-40	1.0	~1.5	9(10)	2.0	≤ -100
~-40	1.0	~1.5	9(10	3.0	≤ -100

PS ... dB	fS ...MHz	fG ...MHz	Switch S1 Position	fE ...MHz	PE ... dB
~-50	1.0	~1.5	10 (11)	1.0	- 30
~-50	1.0	~1.5	10 (11)	2.0	≤ -100
~-50	1.0	~1.5	10 (11)	3.0	≤ -100
~-30	8.0	~9.0	8 (9)	8.0	- 30
~-30	8.0	~9.0	8 (9)	16.0	≤ -100
~-30	8.0	~9.0	8 (9)	24.0	≤ -100
~-40	8.0	~9.0	9 (10)	8.0	- 30
~-40	8.0	~9.0	9 (10)	16.0	≤ -100
~-40	8.0	~9.0	9 (10)	24.0	≤ -100
~-50	8.0	~9.0	10 (11)	8.0	- 30
~-50	8.0	~9.0	10 (11)	16.0	≤ -100
~-50	8.0	~9.0	10 (11)	24.0	≤ -100

4.6.8 10 X 1 dB divider D5287

This divider switches the 1dB steps in the level meter during scale expansion.

If the subassembly has been determined as faulty, proceed in accordance with following instructions.

4.6.8.1 Measuring Equipment required

1 level oscillator, e.g. W2007
1 Precision attenuator, e.g. D120
1 µA multimeter $R_i \geq$ 50 KOhm/V

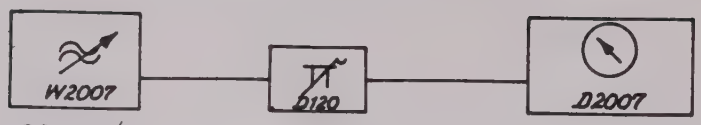
4.6.8.2 Current Consumption

Remove the supply voltage for the subassembly from pin 14 of the printed circuit board and reconnect it via a µA multimeter (10-mA-range).

The current indicated on the µA multimeter should be

$$Io = 3mA \pm 1mA$$

4.6.8.3 Checking the 1 dB steps



p=-20 dB/dBm
Z=75 Ω/coaxial
f= 100 kHz

a=...

p=-40 dB/dBm
Z=75 Ω/coaxial
f= 100 kHz, 80-Hz-Wideband
low noise
S3 in setting...

With the expanded scale switched on (S3 in position 11) and the precision attenuator in position a = 19 dB, adjust the level indication on the level meter with the calibrate potentiometer **to exactly -40 dB/dBm.**

Now check the divider error in accordance with the following table.

Switch S3	Precision Attenuator a= ... dB	Δp (dB)
11	19	± 0,00
10	18	± 0,02
9	17	± 0,02
8	16	± 0,02
7	15	± 0,02
6	14	± 0,02
5	13	± 0,02
4	12	± 0,02
3	11	± 0,02
2	10	± 0,02

4.6.9 Modulator 1 - D5288

In modulator 1 the measuring signal (6 kHz - 18.6 MHz) received from the measuring circuit is modulated with the carrier frequency derived from the f1 oscillator (24 to 42.6 MHz) to **approximately 24 MHz.**

Modulator 1 consists of the carrier amplifier the low pass filter and the actual modulator.

4.6.9.1 Measuring Equipment Required

1 level oscillator W2021 (25 MHz)

1 Frequency control unit G2021 (25 MHz)

1 level oscillator W2072 (100 MHz)

1 Level meter D2072 (100 MHz)

1 Level oscillator D2007

1 Level meter D2007

1 frequency counter

1 oscilloscope with the sampling plug in
e.g. Siemens oscillator M214

1 HF multimeter

1 µA multimeter

4.6.9.2 Current consumption and DC Voltages:

Connect the subassembly via a µA multimeter (100 mA range) to a DC voltage of +14 V ± 0.1V +14V to pin 13/14, chassis (-) on pin 11/12. The multimeter must indicate a current of 57 mA ± 6mA.

Subsequently by means of R65 adjust the voltage at the emitter of Ts8 to a minimum. Guide value U - = 8.5 to 9.5 V using a digital voltmeter or µA multimeter. Check the following DC voltages (against chassis, pins 22-27).

U(V)	Ts1	Ts2	Ts3	Ts4	Ts5
U_C	9.3-11.3	4.7-5.7	7.3-8.9	12.5-13.5	8.0-9.6
U_B	5.4-6.4	1.0-1.4	3.3-3.9	7.6-8.6	3.1-3.7
U_E	4.7-5.7	0.3-0.7	2.6-3.2	6.9-7.9	2.5-3.1

U(V)	Ts6	Ts7	Ts8
U_C	6.9-8.3	8.5-9.9	9.6-10.6
U_B	4.1-4.9	4.0-4.8	8.5-9.9
U_E	4.2-5.0	4.2-5.0	8.0-9.5

4.6.9.3 Checking the carrier amplifier

Lock the f_1 oscillator to f_1 = 1 MHz and measure the voltage at the collector of Ts5 with on HF multimeter

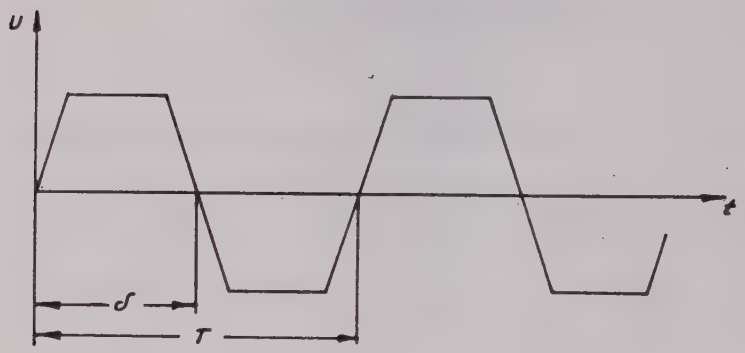
nominal value $U\sim$ = 1.1 to 1.6V

Waveform at the output of the carrier amplifier:

With the oscilloscope check on the emitter of transistor Ts8 the waveform at the frequencies f_1 = 1; 6 and 16 MHz.

By means of potentiometer R65 of the subassembly set the ratio 2:1

The waveform at the above frequencies must correspond to that shown. The amplitude must remain constant.



Nominal value: Amplitude U_{ss} = 2.5 - 3.5 V

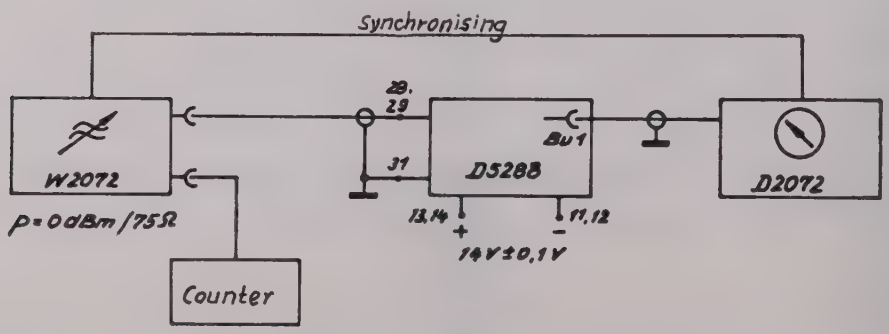
Ratio $\frac{T}{\delta}$ = 2:1

The voltage on connection 4 of U1 should be half that of emitter of Ts 8 i.e.

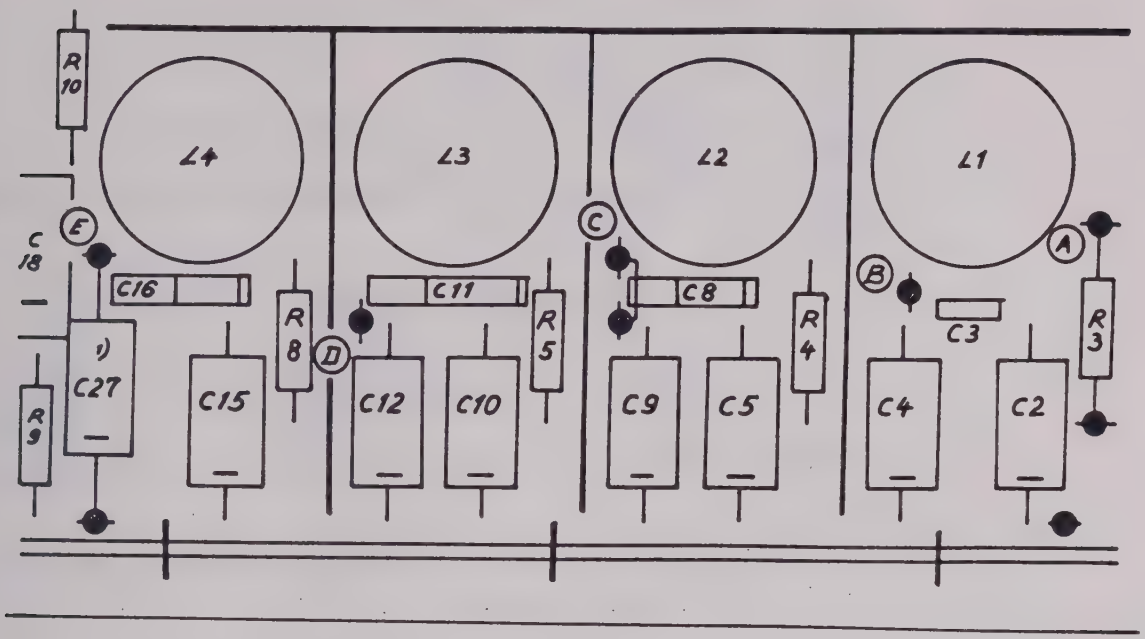
U_{ss} = 1.25 - 1.75 V

4.6.9.4 Adjusting the low pass filter:

For this measurement remove the modulator 1 from the D2007 and adjust as follows - Pole adjustment:



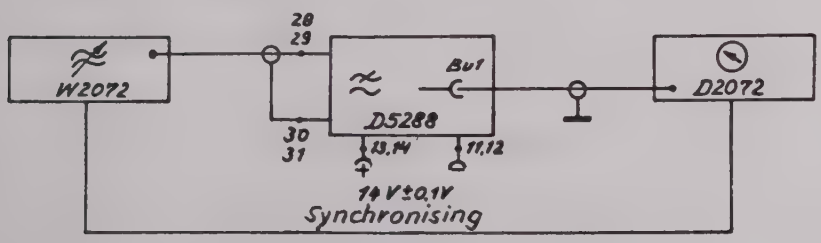
In accordance with the following table, tune the individual circuits of the low pass to maximum attenuation i.e. minimum indication on level meter ($p \leq -70$ dB)



circuit	connection	pole-frequency	adjustment
2	A-B & C-E	25.8 MHz	L2
3	A-C & D-E	24.0 MHz	L3
4	A-D	31.6 MHz	L4

The points indicated are to be connected with a short a lead as possible

Checking the pass band:



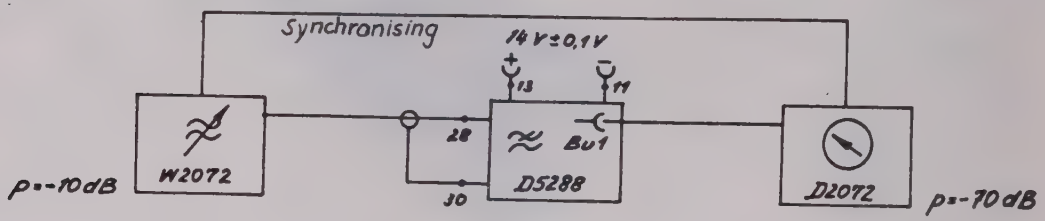
level oscillator: p = -20 dB, f = 100 kHz ± 10 kHz
level meter : p = -30 dB, = bandwidth 3.1 kHz

The basic attenuation of the bandpass is to be measured.

nominal value a_0 = 12 dB ± 1 dB

Stop band attenuation

Insert the subassembly into a **screening can which should correspond** to the screen in the instrument.



Measure the stop band attenuation in the frequency range f = 23.8 MHz to 65 MHz.

nominal value $a_{sp} \geqq 65$ dB

4.6.9.5 Frequency response of the subassembly

The frequency response is best checked with a 18.6 MHz level measuring set up. Insert the subassembly to be tested in place of modulator 1 into a D2007. Level oscillator and level meter D2007 are operated in the synchronised mode.

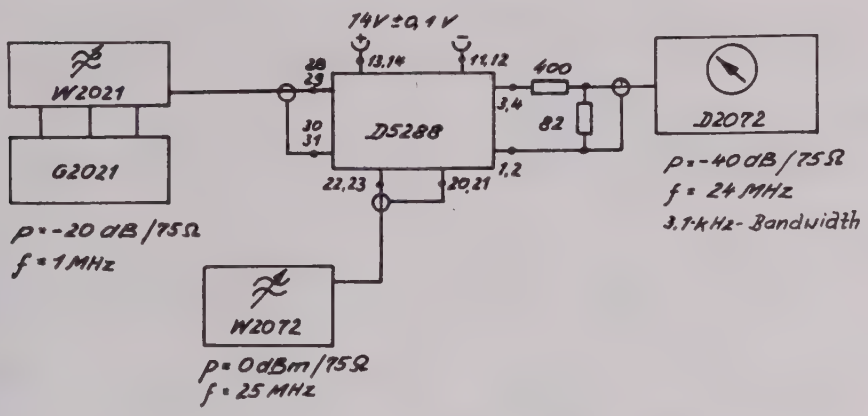
By means of coil L1 (accessible through hole in the side of the mother board assembly), resistor R4 and potentiometer R46 (this allows adjustment of the slope of the frequency response curve) adjust the subassembly for minimum frequency response. (take into consideration the frequency response of level meter and level oscillator).

the frequency response of modulator 1 should be

from 6 kHz to 12 MHz max ± 0.05 dB
from 12 MHz to 15 MHz max ± 0.1 dB
from 15 MHz to 18.6 MHz max ± 0.3 dB

after replacing the subassembly into its original level meter the frequency response will have to be readjusted slightly.

4.6.9.6 Adjusting the basic attenuation of the subassembly



With potentiometer R45 adjust the indication on the level meter to

$$p = -46.5 \text{ dB} \pm 1 \text{ dB}$$

4.6.10 Modulator 2 - D5289

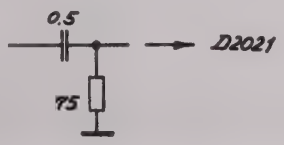
In modulator 2 the 24 MHz IF measuring signal, derived from modulator 1 is modulated with the control signal (f3 = 21.6 to 21.5 MHz) derived from the f2 oscillator to the IF signal of 2.4 MHz.

4.6.10.1 Measuring Equipment and Accessories required.

1 level oscillator W2021 (25 MHz)
1 Level receiver D2021 (25 MHz)
1 Frequency Control Unit G2021 (25 MHz)
1 HF Multimeter
1 µA multimeter

1 Capacitor 0.5 pf
1 Resistor 75 Ohm ± 2%
1 coax connector 1.6/5.6
1 75 Ohm terminating Resistor

Decoupler:



4.6.10.2 Current consumption and DC Voltages:

With a µA multimeter (30 mA range) measure the current consumption of the subassembly

nominal value: Io = 20 mA ± 3 mA

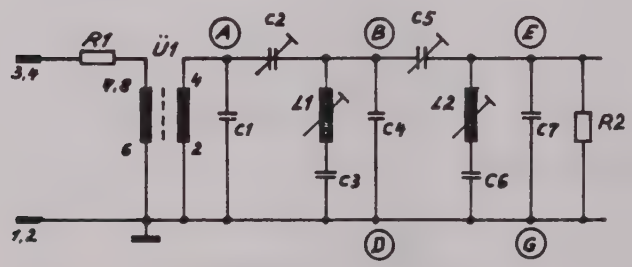
The following DC voltages are to be measured against chassis (pin 1/2) with a digital voltmeter or µA multimeter.

U(V)	Ts1	Ts2	Ts3	Ts4
U_C	11.4-13.4	11.4-13.4	12.6-13.6	12.5-13.8
U_B	8.6-9.6	7.8-8.9	8.1-9.1	3.2-3.8
U_E	7.9-8.9	7.2-8.2	7.4-8.4	2.5-3.1

4.6.10.3 Adjusting the 24 MHz Bandpass

Connect a level oscillator (W2021 + G2021, P = 0dB, Z = 75 Ohm/coaxial, f = 16.1 MHz locked) to the coaxial (75 Ohm) input of the level meter D2007 and connect a level meter (D2021+G2021) to connection 4 of the transformer U1 via the decoupler (see accessories). Insert a coax plug into socket Bu 8 of the D2007 there will no longer be any level on meter indication on D2007, the level plan will be set automatically. Set the frequency to f = 16 MHz (locked).

Adjusting the tuned circuits:



Bandpass filter in Modulator 2

Connect point (B) and (D) ie short circuit the tuned circuit L1/C3.

Adjust the tuning slug of U1 in - D5289 - for maximum deflection on D2021 and note the value indicated.

Remove connection (B) - (D) and connect (E) and (G) i.e. the tuned circuit L2/C6 is short circuited.

Adjust the slug of L1 for minimum indication on D2021. Set trimmer C2 to produce the value $p = p_o - 14.7$ dB $\pm$ 0.1 dB (indication on D2021).

Adjust the slug of L1 after each adjustment of C2 again for minimum deflection on D2021. Remove connection (E) - (G)

Adjust slug of C2 to produce minimum deflection on D2021 and se trimmer C5 to the value p = po -42 dB $\pm$ 0.1 dB (indication on D2021).

Adjust slug of L2 after each adjustment of C5 again to minimum deflection on D2021.

The adjustment procedures must be repeated until no further individual adjustments are necessary.

Fine adjustment of the pass band.

The level oscillator (W2021 + G2021) remains connected to the D2007. The level meter D2021 + G2021 is to be connected to connector Bu 1 of subassembly D5289.

By readjusting U1, L1 and L2 on D5289 a symetrical curve is to be adjusted in the pass band, 23.8 - 24.1 MHz (W2021 + G2021 = 16.2 - 15.9 MHz) ($\Delta p \leq \pm$ 0.02 dB). pass band centre f = 23.95 MHz (W2021 + G2021 = 16.05 MHz). The 3 dB points should be approx f_L = 23.35 MHz (W2021 + G2021 = 16.65 MHz) and approx f_U = 24.5 MHz (W2021 + G2021 = 15.5 MHz).

Hints on the fine adjustment:

If the curve is too strongly concave, screw out the slug of U1 a little, if it is too narrow and round turn the slug inwards.

To keep the attenuation distortion small at higher temperatures a slightly concave curve is preferable to a round curve.

If it is not possible to adjust a symetrical curve after adjusting all coils and U1 e.g. one lump is always greater than the other, the coupling (adjustment of the tuned circuits) has to be carefully readjusted.

Attention: Turn trimmer C2 and C5 only very little

If however the right hand bump is higher than the left, the coupling between the circuits 1 and 2 has to be increased by increasing C2 and the coupling between 2 and 3 has to be reduced by reducing C5.

If the trimmer C2 and C5 are readjusted the 3dB bandwidth has to be rechecked.

If the 3dB bandwidth is too large (small) carefully reduce (increase) C2 and C5 **together.**

Checking the basic attenuation

The test set up remains intact. Set the frequency at W2021 + G2021 to 16.0 MHz.

With a HF multimeter measure at the input of subassembly D5289 (pin 3/4) the voltage U_A and at the output (measuring connector Bu 1) the voltage U_B.

nominal value $\frac{U_B}{U_A}$ = 1.0 to 1.26 this corresponds to an amplification V = 1 $\pm$ 1 dB.

Adjusting C12.

For this adjustment **modulator 2 has to be operated outside** the instrument. With the supply voltage connected **(U = 14 V $\pm$0.1 V)** inject at pin 3/4 a level of approx 0 dB. ($R_i \approx 0$, f = 40.8 MHz $\pm$ 0.5 MHz) and measure at Bu 1 of the modulator - D5289 - the voltage (at 40.8 MHz). During this measurement the band pass must be covered with a screen. Adjust C12 to produce minimum level at Bu 1.

4.6.10.4 Checking the Carrier Amplifier (in D2007)

With a voltage of approx U$\sim$ = 280 mV at pin 20/21 (measured with a HF multimeter) adjust U2 to produce maximum voltage (also measured with a HF multimeter) at connection 6 of U2.

nominal value U$\sim$ = 2.0 to 3.0V (at 6 of U2)

4.6.10.5 Adjusting the basic attenuation (in D2007)

Adjust slug of U3 for **maximum** indication on the meter of D2007

4.6.11 Modulator 3 - D5290

In the modulator 3 the 2.4 MHz IF measuring signal is modulated with the 2.3 MHz oscillator into the 100 **kHz** IF voltage of the D2007.

The subassembly consists of the 2.4 MHz band pass, the 2.3 MHz oscillator and the Modulator itself.

4.6.11.1 Measuring Equipment Required

1 level oscillator W2007
1 level meter D2007
1 oscilloscope with amplifier output for connection of frequency counter
1 capacitive divider probe or probe for D2007
1 HF multimeter
1 µA multimeter

4.6.11.2 Current consumption and DC voltages

with a µA multimeter (30 mA range) measure the current consumption of the subassembly

nominal value **Io** = 18 mA ± 2mA

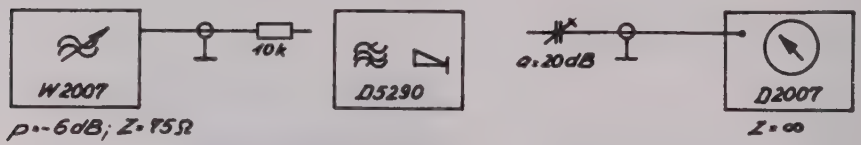
The following DC Voltages are to be measured against chassis (pins 3...12) **with a digital voltmeter or µA multimeter**

U(V)	Ts1	Ts2	Ts3	Ts4
U_C	9.0-10.6	7.8-8.2	11.4-13.4	12.1-13.5
U_B	4.4-5.4	2.8-3.4	7.8-9.2	1.6-2.0
U_E	3.8-4.6	2.2-2.6	7.1-8.5	0.9-1.3

4.6.11.3 2.4 MHz Bandpass **filter**

For this adjustment the subassembly must be operated outside the D2007.

The supply voltage U = 14V ± 0.1 V **is to be applied to pins 13/14** (against chassis). The adjustment is carried out according to the following table.



The crystal Kr of the subassembly is to be short circuited

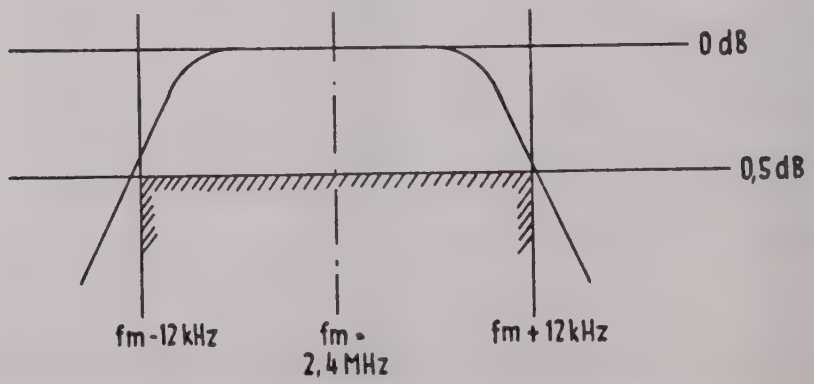
W2007-			-D5290-	-D2007-		
p	f	inject at	adjust	p*)	f	measure at
-6 dB	2.2MHz	L1/4	L1	≦-93dB	2.2MHz	L1 4
-6 dB	2.2MHz	L2/4	L2	≦-93dB	2.2MHz	L2 4
-6 dB	2.4MHz	30/31	L3	-20dB± 1dB	2.4MHz	EMITTER Ts1

*) includes 20 dB divider attenuation

The specifications of the band pass **has to be checked** (if necessary readjust L1, 2 and 3)

Fall off of the curve at a = 0.5 dB at fm = 2.4 MHz ± 12 kHz

Ripple in the pass band max 0.05 dB



After the adjustment remove the short circuit from crystal Kr and secure coils L1, 2 and 3 to prevent detuning.

4.6.11.4 Crystal oscillator f - 2.3 MHz

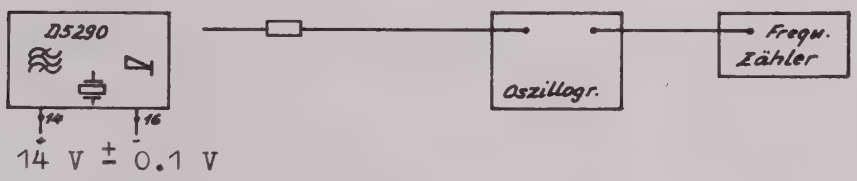
The subassembly remains connected to the power supply (U- =14 V ± 0.1V) as in 4.6.11.3. The short circuit **on the crystal Kr must be removed.**

Adjustment of U1

Connect a µA multimeter (100 µA range) to R25 of the subassembly (multimeter parallel to R25) Adjust U1 for maximum indication on the multimeter

nominal value I ≈ 40 µA

Adjusting the oscillator frequency



Connect the oscilloscope to connection 1 of the transformer U1, ie to soldering pin 2. The frequency of the oscillator can now be measured via the oscilloscope.

By means of trimmer C17 adjust the oscillator frequency to

f = 2.3 MHz ± 5 Hz.

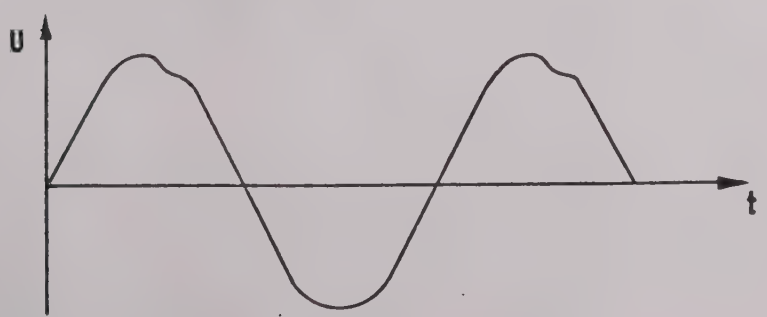
Amplitude:

With a HF multimeter measure the voltage against chasis at connection 1 of transformer U1 (soldering pin 2).

nominal value $U_{\sim}$ = 2.5 -3V RMS

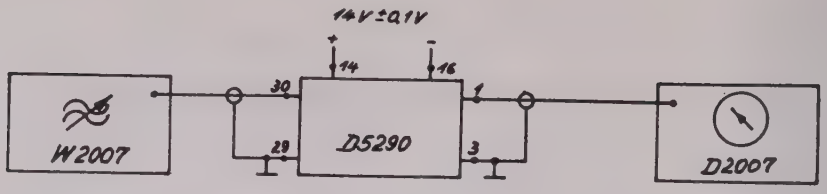
Waveform:

By means of the oscilloscope check the wave shape at connection 1 of the transformer U1



4.6.11.5 Functional Test of Circuit Board

Test set up:



p = - 36 dB
Ri = 75 Ohm
f = 2.4 MHz locked-in

p = - 10 dB
Z ≈ ∞
f = 100 kHz, locked-in

Adjustment of U2

Set potentiometer R13 and R14 to mid position. Adjust U2 of the subassembly for maximum indication on the level meter.

nominal value

p = -17.8 ± 0.5 dB (indication on D2007)

4.6.11.6 2.3 MHz Output

The level meter (high impedance with probe) is now connected to pin 19/20 of the subassembly (against chassis).
The nominal value indicated by the level meter should be

p = -36 dB± 2dB

This value takes into consideration the 20 dB probe attenuation.

4.6.12 80 Hz Crystal Filter - D5291-

This crystal bandpass filter has a 3 dB bandwidth of approx 80 Hz. It is switched into circuit with S5 through a relay (S).

4.6.12.1 Measuring Equipment Required

1 level oscillator e.g. W231 (1.6 MHz)
1 level meter e.g. D354 (1.6 MHz)
1 Frequency Counter
1 Scale expander
1 µA multimeter

4.6.12.2 Checking the DC Voltages:

The following DC voltages are to be checked with a digital voltmeter or a µA multimeter against chassis (pins 3....12).

U(V)	Ts1	Ts2
U_C	12.4-13.8	12.4-14.0
U_E	7.6-8.6	5.4-6.4
U_B	7.0-8.0	4.8-5.8

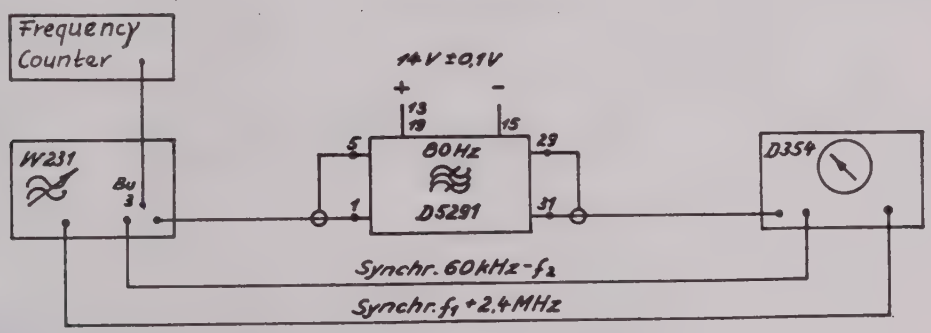
4.6.12.3 Current Consumption

With a µA multimeter (30 mA range) measure the current consumption of the subassembly. (+14V at pin 13, 14, 19 and 20 against pin 15, 16).

nominal value: Io = 18mA ± 3 mA

4.6.12.4 Adjusting the bandpass filter

Test set up:



W231: p = 0dB
Z ≈ 0
f = 80 KHz ± 0.1 KHz

D354: Selective, calibrated
Z = 10 KOhm ||
60 pf

With f2 adjust **level meter** to maximum deflection

Adjust the poles according to Table:

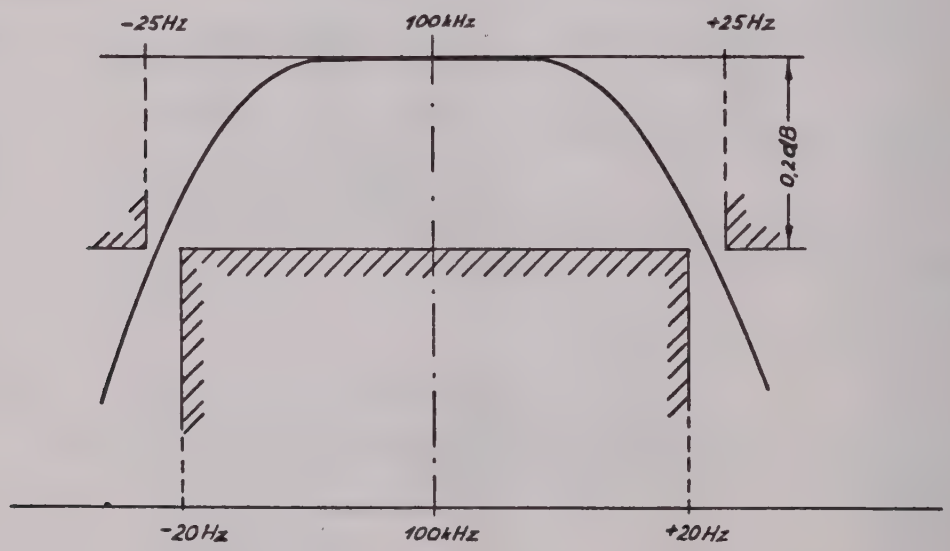
Short circuit or connect 1)	Frequency at W231	Adjust min. indication with	P_{min}	Remove short circuit
Kr2 + Kr3	80kHz ± 100Hz	C2	≦ -83 dB	Kr2 + Kr3
Kr1 + Kr3		C10		Kr1 + Kr3
Kr1 + Kr2		C15		Kr1 + Kr2

1) with short wire:

Adjusting of U1, U2, U3

Transmit frequency f = 100 kHz ± 10 Hz (locked) level meter setting 0 dB.

Adjust U1, U2, U3 for maximum indication on the level meter. Then adjust U1, U2 and U3 again for the following filter response.



After adjustment the filter curve must be outside the shaded tolerance areas.

Hints on adjustments

a) Reduce (increase) the inductance of U1 and U3 until the until the pass band shows no bumps.
b) The pass band is increased if the inductance of U2 is reduced.
c) Certain slopes of the pass band can be eliminated through adjustment on U1 and U2.
d) By adjusting U2 a small overall slope can be eliminated.
e) If the pass band falls at high (low) frequencies reduce (increase) R10. After adjustment secure the slugs of the transformers U1, U2 and U3.

4.6.12.5 Adjusting the amplification

The test set up remains intact but the transmit level is adjusted to p = -10 dB and the frequency to f = 100 kHz ±20 Hz. Connect the scale expander to the level meter. With potentiometer R11 adjust the amplification of the subassembly so that the level meter shows p = -11 dB ± 0.2 dB i.e. a = 1dB ± 0.2 dB. The final adjustment of the amplifier is carried out in the instrument (according to 3.5 maintenance).

4.6.12.6 Stop band

Remove the scale expander from D354

With a frequency variation of $\Delta f = \pm 400$ Hz from the centre of the pass band the level indication on the level meter must decrease to $p \leqq -64$ dB i.e. stop band attenuation $a \geqq 53$dB at $\Delta f = \pm 400$ Hz.

With a frequency variation of $\Delta f = \pm 1$ kHz from the centre of the bass band the indication at the level meter must decrease to p -82 dB i.e. stop band attenuation.

$$a \geqq 71\text{dB} \quad \text{at} \quad \Delta f = \pm 1 \text{ kHz}$$

At approx 228 kHz the indication on the D354 should decrease to $p < -47$ dB i.e. stop band attenuation

$$a \geqq 36 \text{ dB at} \quad f = 228 \text{ kHz}$$

4.6.12.7 Checking the Relays

The test set up remains as in 4.6.12.4. The frequency is set to f = 100 kHz ± 20 Hz.

If the voltage at pin 19/20 is removed the relay must drop out and the output signal must be attenuated by more than 70 dB.

4.6.13 1.74 kHz Filter D5150

This subassembly contains a coil band pass filter 3dB bandwidth B ≈ 6 kHz and a mechanical bandpass with an effective noise band width of 1.74 kHz.

4.6.13.1 Measuring Equipment Requirements

1 level oscillator e.g. W231 (1.6 MHz)
1 level oscillator e.g. W2007
1 level meter e.g. D354 (1.6 MHz)
1 level meter e.g. D2007
1 frequency counter
1 oscilloscope
1 sweep attachment G2022 with plug in W940
1 Level tracer D2001 with plug in D916
1 scale expander B977
1 Probe B2075
1 Measuring Oscillator e.g. W38
1 DC Power Supply 14V stabilised
1 µA multimeter, $R_i \cong$ 50 KOhm/V

4.6.13.2 Current consumption and DC voltages.

Connect the subassembly via a µA multimeter (30mA range) to the DC power supply (U_B = 14V ± 0.1V, + pole to pin 13/14 pole to pin 17/18).

The current indicated on the multimeter should be

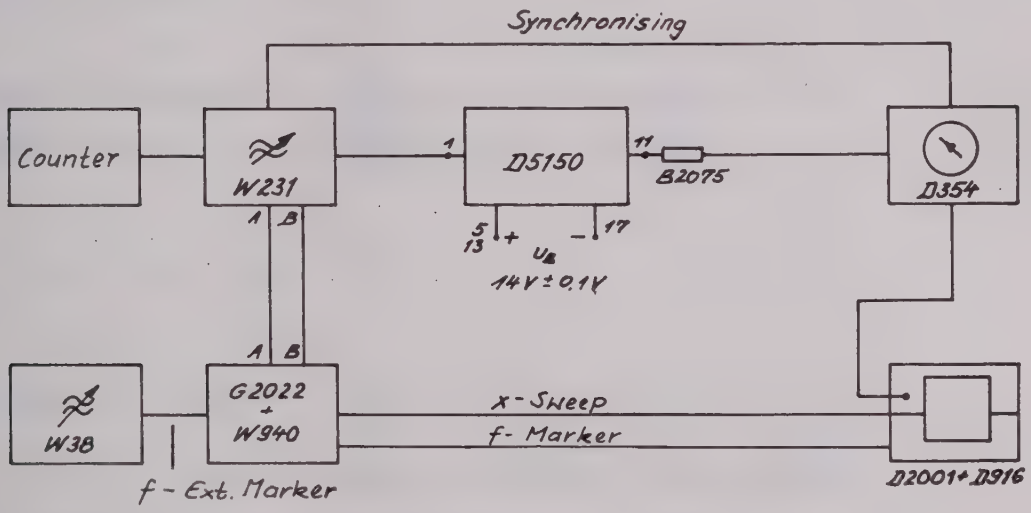
Io = 12mA ± 2mA

The following DC Voltages are to be checked with a digital voltmeter a µA multimeter against chassis (pin 17/18)

U(V)	Ts1	Ts2	Ts3	Ts4
U_C	7.7-9.2	11.6-13.6	12.5-13.6	4.5-5.3
U_B	4.5-5.5	3.9-4.7	6.0-7.2	3.4-4.0
U_E	3.9-4.9	3.3-4.1	5.3-6.5	2.8-3.4

4.6.13.3 Adjusting the coil band pass filter

Connect chassis potential to soldering pin 4 - connection 1 of the mechanical filter - (input of the mechanical filter short circuited).



Settings of the Measuring Equipment

Level oscillator - W231 : f = 100 kHz, p ≈ 0dB, R_i ≈ 0 Ohm/ coaxial

Pegel messer - D354 : p ≈ 0 dB/low noise selective Z = ∞/coaxial

Measuring Oscillator W38 : f = 2.8 kHz, p = 0dB

Sweep attachment : Frequency range 6-12 kHz, centre frequency 100 kHz, control "manual" in mid position. Sweep frequency 0.05 - 0.5 Hz adjust so that forward and reverse curves coincide.

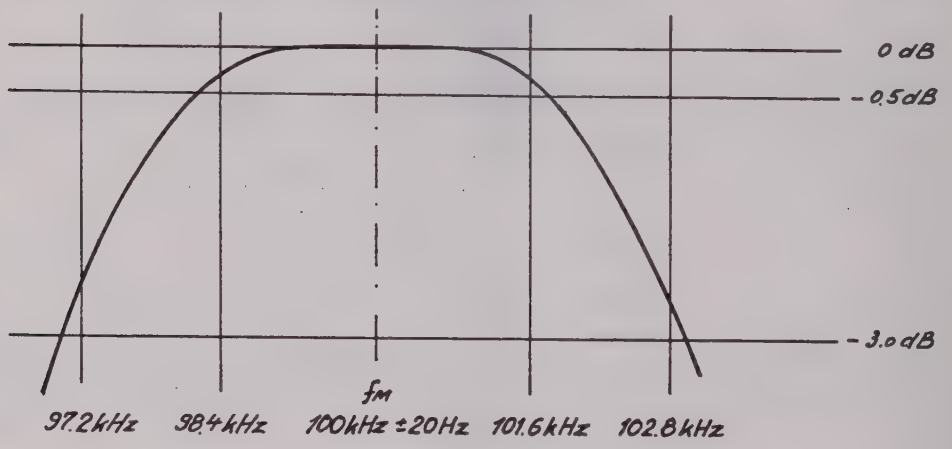
Level Tracer : Expansion and position horizontal: the sweeps range should fill the screen.

Expansion and position vertical: Switch on preamplifier in plug-in turn "verticalgain" slowly to the right hand stop. Set "vertical position" so that the peak of the pass band is in the upper half of the screen.

Frequency markers : Set 2 single line("birdie") markers one at 97 and one at 103 kHz

Adjusting the band pass filter:

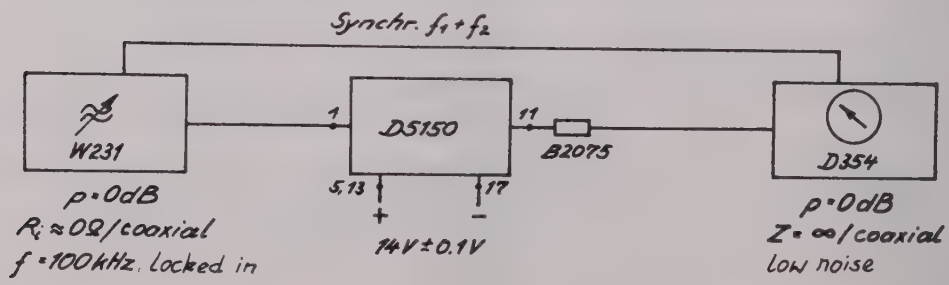
By alternatively adjusting the slugs of L1, L2 and L3 set the following curve:



The filter curve must be symetrical with respect to the centre frequency.

Remove the short circuit at the input of the mechanical filter

4.6.13.4 Basic attenuation of the 6 kHz filter



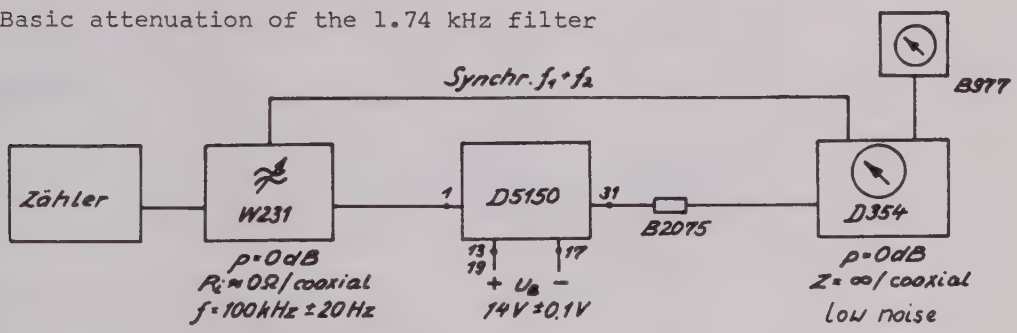
By means of **the level meter measure** (via probe B2075) the output level of the subassembly. Indication on level meter:
p = -1.0 ± 0.2 dB.

Note the value.

The basic attenuation of the filter is therefore a = 1 dB ± 0.2 dB.

4.6.13.5 1.74 kHz Filter

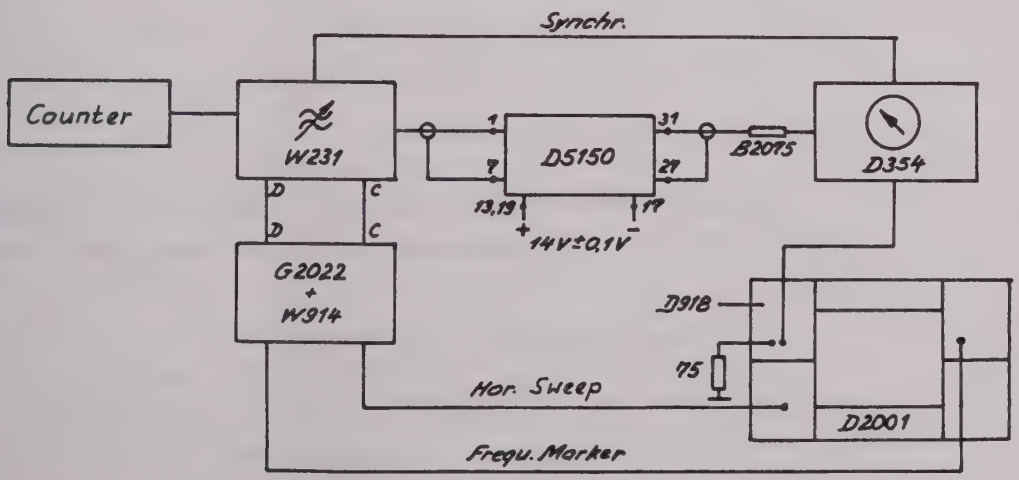
Basic attenuation of the 1.74 kHz filter



With potentiometer R9 of the subassembly set the indication to value noted in 4.6.13.4.

Pass band of the filter.

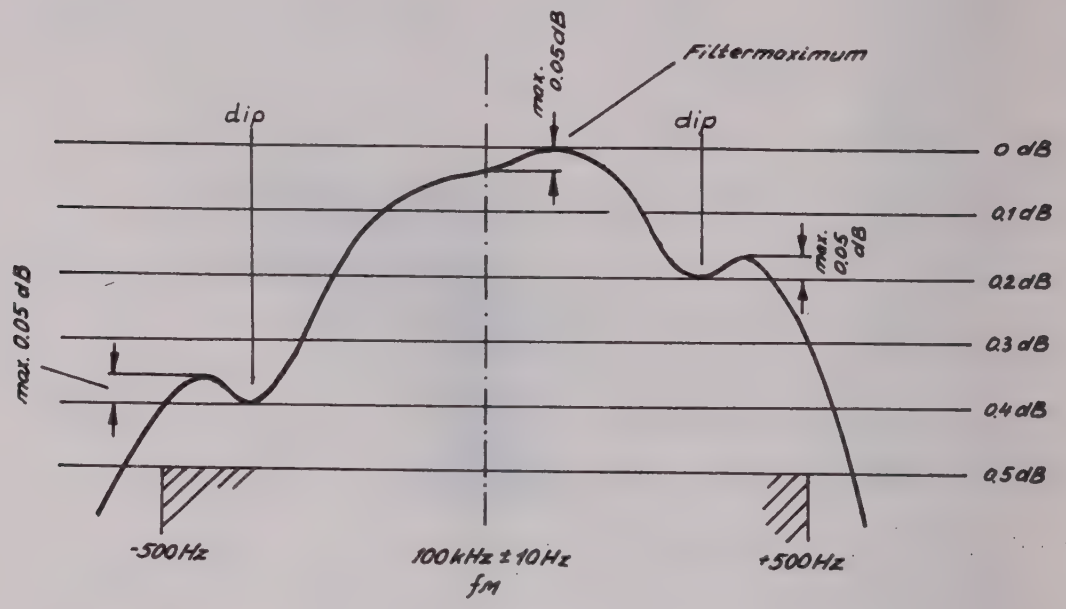
During the following measurement the subassembly must be covered with a **piece of sheet mild steel on the component side. This This sheet should be approx. 0.5 mm from the mechanical** filter



W231: p = -20dB; $R_i \approx 0$ Ohm/coaxial; f = 100 kHz $\pm$ 10 Hz (check with counter)

D354: Z = ∞ /coaxial; low noise; selective

The filter curve should have the following shape



The maximum of the filter curve should not deviate by more than 0.05 dB from the value measured at f = 100 kHz $\pm$ 10 Hz. Dips in the pass band should not be greater than 0.05 dB. Bandwidth (Δa = 3dB).

By varying the frequency at W231 (monitored with frequency counter) determine the frequency at the-3 dB level points.

nominal value $\Delta f \geqq \pm$ 880 Hz.

Stop band attenuation (a $\geq$ 80 dB)

By varying the frequency at W231 (monitored with a frequency counter) determine the frequency points at 80 dB level drop points.

nominal value $\Delta f \leqq \pm$ 2 kHz

In place of the set up D354/W231 use the measuring set up D/W 2007 (without lock in and expanded scale).

In the range f = 102 kHz to 2.3 MHz the stop band attenuation must be as greater than 80 dB

$$a_s > 80 \text{ dB}$$

4.6.13.6 Checking the output 15/16

At pin 1/2 of the subassembly connect a level oscillator (p = -50dB, R_i = 75 Ohm/coaxial, f = 100 kHz). At pin 15/16 connect a 2 KOhm resistor to chassis (pin 17, 18) and an oscilloscope.

A **sine** wave of

$$U_{15/16} = 0.4\ V_{pp} \pm 0.1V \text{ must be indicated.}$$

If the transmit level is increased to p = -20dB, a square wave of $U_{15/16} = 2.7\ V_{pp} \pm 0.3V$ must be indicated.

4.6.14. 100 KHZ Pre-amplifier -D5293-

IN this subassembly the corrections for the impedance values are carried **out for dBm instruments, by means of an inductive** divider. Also, via inductive dividers, switching of the attenuators in the 100 kHz - IF of the D2007 is carried out in this subassembly.

For testing, the subassembly is operated outside the D2007.

4.6.14.1 Measuring Equipment required

1 level oscillator e.g. W231 (1.6 MHz)
1 level meter e.g. D354 (1.6 MHz)
1 digital level meter D2010/14
1 precision attenuator D120 or D2054 + B2054
1 /uA Multimeter $R_i \cong$ 50K Ohm/V
1 DC power supply, stabilised, 14V
1 Resistor, 7.5K Ohm ± 1%, 0.15W
1 Resistor, 75 Ohm ±1 %, 0.15 W

4.6.14.2 Current consumption and DC Voltages

The subassembly is to be connected with its connection points 6, 11, 13/14 and 28 to a DC power supply ($U_{=}$ = 14V ± 0.1V against chassis connection 15/16 of the subassembly) via a /uA multimeter (30 mA range).

Current consumption of the subassembly should be

$$Io = 17\ mA \pm 2mA$$

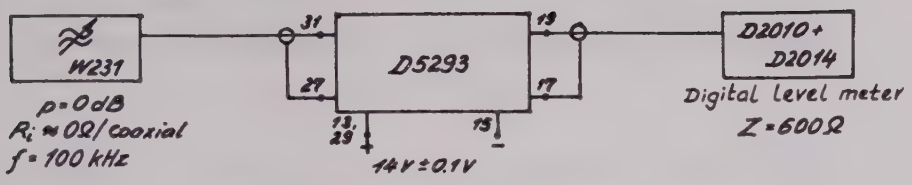
When the power supply is also connected to pin 29 of the 31 pin connector strip the current indicated on the multimeter should rise to $Io = 30mA \pm 3\ mA$

The following DC Voltages are to be checked with a digital voltmeter or /uA multimeter against earth (pin 3.....5).

U(V)	Ts1	Ts6	Ts8	Ts10	Ts11
U_C	4.1-5.1	10.2-12.2	10.2-12.2	5.7-6.9	9.8-11.2
U_B	4.8-5.8	5.0-6.0	4.9-5.9	2.0-2.4	5.7-6.9
U_E	4.1-5.1	4.4-5.4	4.2-5.2	1.3-1.7	5.2-6.2

U(V)	Ts12	Ts15	Ts22	Ts24	Ts25
U_C	5.2-6.2	4.1-5.1	4.1-5.1	9.0-11.0	11.9-13.9
U_B	9.8-11.2	4.8-5.8	4.8-5.8	4.0-5.0	9.5-10.5
U_E	10.2-12.2	4.1-5.1	4.1-5.1	3.5-4.4	8.9-9.9

4.6.14.3 Checking the log output



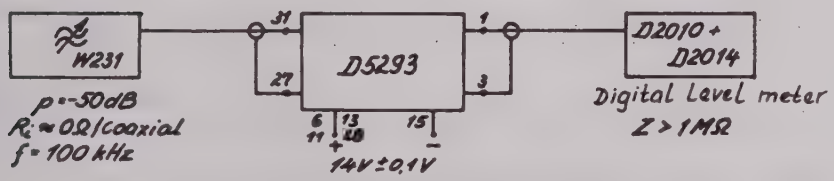
Set potentiometer R27 of subassembly D5293 to mid position
The digital level meter should show a level of

$$p = -2.5\ dB \pm 0.5\ dB$$

If the voltage is removed from pin 29 **the relay V must drop out** and the indication on the digital level meter must fall to

$$p \leq -40dB$$

4.6.14.4 Checking the amplifier



prior to this measurement check at pin 30/31 if the level oscillator supplies exactly -50dB.

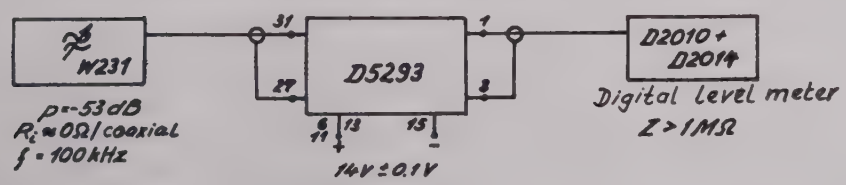
Measurement:

The digital level meter must show

$$p = -16.5\ dB \pm 1\ dB$$

This corresponds to an amplification in the subassembly of 33.5 dB

4.6.14.5 Checking the dB/dBm - divider



In addition to the connection to the pins stated in the test set-up, apply a voltage of +14 V ±0.1 V to pin 28. Now adjust the transmit level so that the digital level meter shows a round value, e.g.

p = -20.00 dB

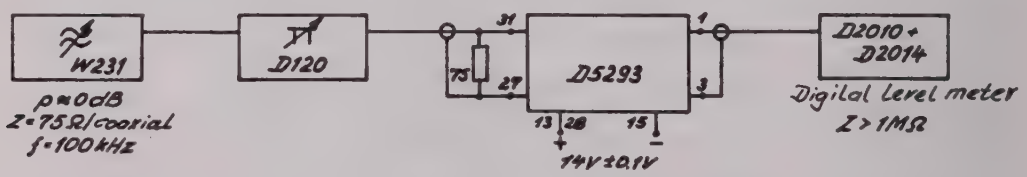
In accordance with the following table apply a voltage of +14V ± 0.1V at the pins indicated and measure with the digital level meter set the deviations from the previously set round value

e.g. -20.00 dB

Apply voltage to pins	Remove voltage from pins	Indication on D2010/14(dB)	Z-Value D5293	
6, 11, 28	-	-20,00		
6, 11, 26	28	-20.97± 0.02	75 Ohm	
6, 11, 24	26	-23.15± 0.02	124 Ohm	
6, 11, 24	26	-23.36± 0.02	130 Ohm	*)
6, 11, 22	24	-23.52± 0.02	135 Ohm	
6, 11, 22	24	-23.68± 0.02	140 Ohm	*)
6, 11, 21	22	-23.98± 0.02	150 Ohm	

*)These are special values and are not normally supplied.

4.6.14.6 Checking the IF Attenuator steps



In addition to the pins indicated in the 1st set up apply a voltage of +14V ± 0.1V to pins 6 and 11. Set the precision attenuator to a = 50 dB and adjust the transmit level so that the indication on the digital level meter is a round value e.g. p = -20.00 dB.

In accordance with the following table apply a voltage of +14V ± 0.1V and measure with the digital level meter the deviation from the previous value e.g. -20.00 dB. Take into consideration the divider error of the attenuator D120

Attenuator a = ...dB	Voltage on Pin No.	Remove voltage from pin No.	Indication on D2010/14(dB)
50	6, 11	-	20.00
40	7; 11	6	-20.00±0. 02
30	8, 11	7	-20.00±0. 02
20	9, 11	8	-20.00±0. 02
10	10, 11	9	-20.00±0. 02
30	6, 12	10,11	-20.00±0. 02

4.6.15 100 kHz Final Amplifier D5294

In the 100 kHz Final amplifier the measuring signal is amplified by approx 63 dB for the linear instrument indication and the 100 kHz IF output (100 kHz/75 Ohm).

For the test the subassembly is operated outside the D2007.

4.6.15.1 Measuring Equipment and Accessories Required.

1 Level Oscillator e.g. W231 (1.6 MHz)
1 Level Meter e.g. D354 (1.6 MHz)
1 Scale expander D977
1 precision attenuator D117
2 µA multimeter
1 Frequency Counter
1 DC power supply, stabilised +14V
1 Resistor, 75 Ohm ± 1% 0.15W
1 Capacitive Divider Probe a = 20 dB

4.6.15.2 Current Consumption and DC Voltages

Connect the subassembly via µA multimeter (30 mA range) to the DC power Supply (U- =14V ± 0.1V, + pole to pin 13/14 , - pole to pin 11/12 of the subassembly)

Current Consumption should be

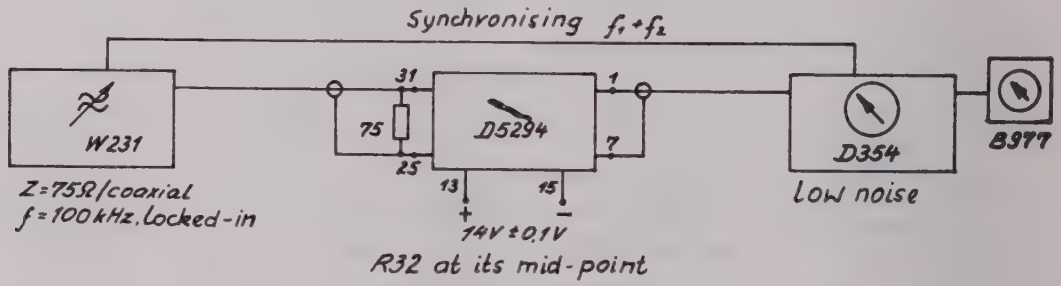
$$I_o = 24\ mA \pm 3mA$$

The following DC voltages are to be measured with a digital voltmeter or /uA multimeter against chassis (pin 11/12)

U(V)	Ts1	Ts2	Ts3	Ts4	Ts5
U_C	3.8-4.6	9.5-10.7	6.0-7.2	11.9-13.9	12.5-13.8
U_B	2.2-2.6	2.0-2.4	1.8-2.2	6.0-7.2	8.8-9. 8
U_E	1.6-2.0	1.4-1.8	1.2-1.6	5.4-6.6	8.2-9.2

U(V)	Ts6
U_C	4.1-4,9
U_B	3.5-4.1
U_E	~ 0

4.6.15.3 Measuring the amplification



Adjustment of the transformer U2, amplfier VI.

W231 p = -70 dB

D354 p = 0 dB, Z = ∞/coaxial

Adjust transformer U1 to produce maximum deflection at level meter

nominal value p = -6 dB ± 0.5 dB

Adjustment of the transformer U2, amplifier V2.

W231 p = -70 dB
D354 p = -10 dB, Z = 75 Ohm/coaxial,
connected to pin 5.6 of subassembly -D5294-

Adjust transformer "U2" to maximum indication on level meter
nominal value P = -17 dB ± 0.5 dB

4.6.15.4 Checking the Dynamic Range

The level oscillator (p = -50 dB, Z = 50/coaxial, f = 100 kHz locked, synchronised with the level meter), remains connected to pin 30/31. The level meter (p = + 10 dB, Z = 75 Ohm/coaxial) is connected to pin 5.6

The indication on the level meter must now be 20 dB ± 0.2 dB higher than the previously measured value.

4.6.16 Measuring Circuit board D5295

In this subassembly the DC voltage proportional to the input signal is produced for the instrument indication and the recorder output. Further the 1.35 kHz signal required for the modulation of the measuring signal to VF range, is produced by an oscillator on this board.

The subassembly is tested partly in, and partly outside the D2007.

4.6.16.1 Measuring equipment required

1 level oscillator W2007
1 level meter D354 with capacitive divider or probe B2075
1 frequency counter
1 oscilloscope with amplifier output.

4.6.16.2 Current Consumption and DC voltages

Connect the subassembly via a µA multimeter (30mA) range to the DC power supply (U = 14V ± 0, V + pole to pin 13/14, - pole to pin 27/28).

current consumption

I_o = 11,0 mA ± 2 mA

The following DC voltages **should be measured with a digital** voltmeter or a µA multimeter against chassis (pin 3/4)

U(V)	Ts1 *)	Ts2	Ts3	Ts4	Ts5
U_C	8.0-9.6	6.3-7.7	6.5-7.7	12,0-13,6	12.0-13,6
U_B	0.4-0.8	0.2-0.6	1,8-2.2	6.5-7. 7	1.8-2. 2
U_E	0.6-1,0	0.1	1,2-1,6	6,0-7. 0	1.2-1. 6

***)without input signal, with scale spread device switched on**

Also connect the power supply for the expanded scale. To do this the +14 V ±0.1 V should be applied to pins 15/16 as well (-pole at pin 11/12).

The current indicated on the level meter should rise to

J_{o1} = 48 mA ± 5mA

4.6.16.3 **Checking** and adjusting the rectifier circuit

Connect a level oscillator (p≈ 0 dB Z = 75 Ohm/coaxial, f=100 kHz) to the D2007 (in which the subassembly is situated). To Bu 9 of the D2007 connect the level meter D354 (p = 0 dB, Z = 75 Ohm/ coaxial, f = 100 kHz). Adjust the transmit level so that the level meter D354 (tuned to 100 kHz) shows exactly 0 dB. (this corresponds to a level at the input of the measuring circuit (pin 1/2) of p = + 9 dB ± 0.2 dB.

Now make certain that the resistor R13 (between soldering pins 10 and 11 on D5295 and the instrument resistance add up to 4.5 k Ohm ± 50 Ohm. To the recorder output (Bu 13 of D2007) connect a digital voltmeter (a - against b conductor - do not connect c connector).

The potentiometer R8. 10 and 12 are in mid position.

Adjustment 1

Adjust potentiometer R10 so that the instrument pointer is on the 0 dB mark on the upper scale. Then adjust R12 so that the digital voltmeter (on Bu 13) shows $U_{\sim}$ = 200 mV.

Adjustment 2

The following adjustment processes are to be carried out alternately (transmit level $\approx$ 0 $\triangleq$ 0 dB at Bu 9).

Adjust R8 to produce indication 0 dB at level $\approx$ 0 dB
" R12 " " " " -10dB " " " $\approx$ 10 dB
" R 8 " " " " 0dB " " " $\approx$ 0 dB
" R12 " " " " -10dB " " " $\approx$ 10 dB

Continue this adjustment procedure until no further deviations occur. Thereupon check adjustment 1; if further adjustment is required also repeat adjustment 2.

4.6.16.4 Adjusting the indication amplifier (scale expander)

Set the transmit level again to p$\approx$ = 0 dB (see above). Potentiometers R24 and R30 are in mid position. By means of switch S3 switch in the scale expander (0 dB).

Adjustment 3

Adjust potentiometer R30 so that the instrument pointer is on the 0 dB mark on the lower scale.

Adjustment 4

Now carry out the following adjustment alternately (transmit level p$\approx$ 0$\triangleq$dB at the D354, p $\approx$ + 1 dB $\triangleq$ + 1 dB at D354)

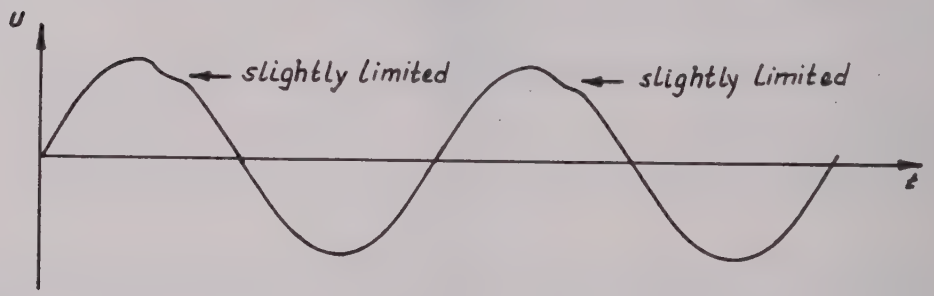
Adjust R30 to produce indication 0 dB at transmit level ≈ 0 dB
" R24 " " " +1 dB " " ≈ +1 dB
" R30 " " " 0 dB " " ≈ 0 dB
" R24 " " " +1 dB " " ≈ +1 dB

Continue this adjustment procedure until no further deviations occur.

4.6.16.5 Checking the SSB oscillator

With a transmit level of ≈ 0 dB (i.e. 0 dB at Bu 9 of the D2007) at the input of the D2007 set switch S7 of the D2007 to position lower sideband.

With the oscilloscope and divider probe 10:1 examine the **waveform at U1, connection against chassis (pins near C15)**



nominal value U = 13.5 - 16.5 Vpp

Frequency Adjustment 1

Connect a frequency counter to the amplifier output of the **oscilloscope. Set C16 2/3 open and C18 1/2 way open. By adjusting** U1 set the frequency to f = 98.65 kHz ± 50 Hz.

Adjusting the output level

Connect the level meter D354 to the "a" conductor of Bu 12 (against "b" conductor) of the D2007 (Z = 600 Ohms).

By means of a frequency counter (at Bu 9) check the IF frequency of the D2007, f = 100 kHz ± 10 Hz and if necessary correct it (by adjusting f2 of the D2007 and matching the transmit frequency to the frequency of the D2007).

With potentiometer R37 on the measuring circuit board set the output level (switch S7 in position as before, level meter D354 tuned to 1.35 kHz) to p = 0dB.

Adjusting the output frequency

The IF frequency remains 100 kHz ± 10 Hz, switch S7 **to the previous** position (voltage +14V at pin 24, 25 of the measuring circuit board).

Adjust trimmer C18 to produce an output frequency at Bu 12 of the D2007 of 1.35 kHz ± 50 Hz. Now set switch S7 in the opposite position (= upper side band) and by adjusting trimmer C16 set the frequency again to 1.35 kHz ± 50 Hz.

Repeat both adjustments until both frequencies are approximately equal.

4.6.17 AFC and overload board D5296

This subassembly houses the circuit for the automatic frequency control and the circuit for the overload indication of the D2007.

4.6.17.1 Measuring Equipment and Accessories required

1 level oscillator e.g. W2007
1 oscilloscope with probe 1:10
1 subassembly -D5276-; tested
1 µA multimeter
1 Digital voltmeter
1 frequency counter
1 75 Ohm resistor
1 DC power supply, 14V stabilised.

4.6.17.2 Current consumption and DC voltages

Connect the subassembly via a µA multimeter (100 mA range) to the DC power supply (Ub = +14V ± 0.1V) (+pole to pin 13/14 pole to pin 15/16 of the subassembly).

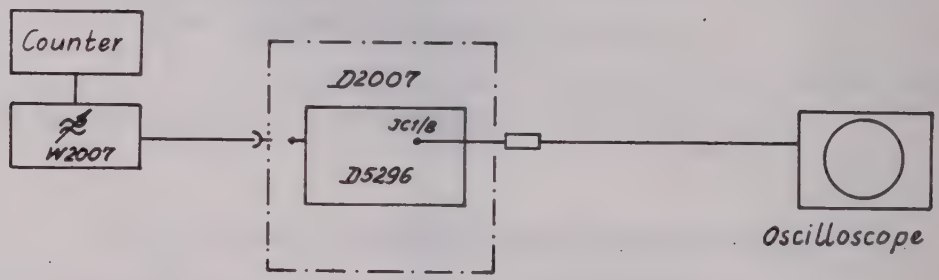
Current consumption should be

$$Jo = 50\ mA \pm 5\ mA$$

With a digital voltmeter or /uA multimeter check the following DC voltages against chassis (pin 15/16)

U(V)	Ts2	Ts5	Ts6	Ts7
U_C	7.8-9.4	7.3-8.9	10.5-12.5	7.9-9.5
U_B	4.7-5.7	5.1-6.1	6.2-7. 2	5.5-6.5
U_E	4.0-5.0	4.4-5.4	5.5-6. 5	4.8-5.8

4.6.17.3 Checking the AFC circuit

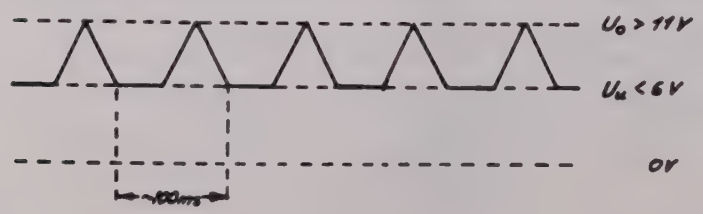


Connect a cable (other and open) to Bu 8 of the D2007 to operate the switch contact on the connector.

Connect an oscilloscope to pins 9/10 of the subassembly.
Connect a frequency counter to the amplifier output of the oscilloscope and measure the output frequency of the subassembly -D5276- and adjust if necessary with C8 (-D5276) to f = 100.00 kHz ± 1 Hz.
Now connect the oscilloscope via the 10:1 divider probe to the soldering pin next to the connection of capacitor C10 ie to connections 8 of IC1.

Increase the frequency of the transmit signal p_s = -30dB, Z = 75 Ohm/coaxial) of the W2007 from f= 100 kHz by 1 Hz.

The oscilloscope should show the following signal



Remove the oscilloscope from connection 8 of IC1 to pin 17/18 of the subassembly,

A waveform similar to that of connection 8 of IC1 should be seen.

The oscilloscope remains connected to 17/18. Set switch S8 to AFC off (.◯). The relay should switch over and the oscilloscope should indicate $U_{_}$ = 7.8V ± 0.1V.

Checking the AFC indication

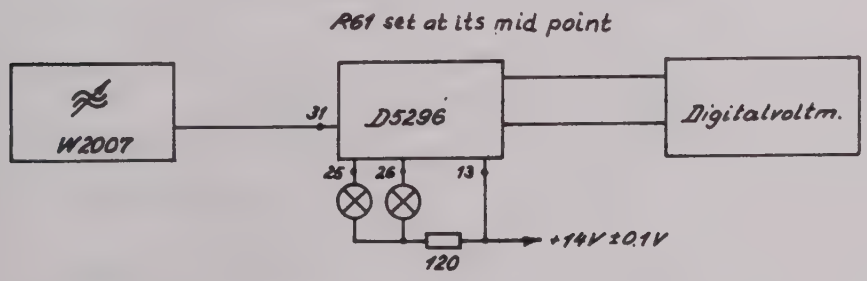
With a variation of the transmit frequency of 100 Hz the AFC lamp Lp1 should not light (at pin 23/24) if the frequency is again brought in the proximity of a 100 kHz the lamp should **first blink and then light when the frequencies at ipunt 9/10 and input 3/4 are equal.**
If now, whilst the lamp is alight, the transmit level of the W2007 is reduced to p_s = -50dB the lamp must remain alight.

When increasing the frequency of the W2007 the lamps must first blink then go off. With the AFC switched off (S8) a voltage of 7.8V ± 50 mV must be present at pin 17/18 ie the output of the subassembly (adjustable with potentiometer p3).

4.6.17.4 Checking the overload - circuit

The circuit is tested partly inside and partly outside of the level meter

Checking the amplification and frequency response



Connect the digital voltmeter to soldering pins 13 and 12. Adjust the transmit level of W2007 to p_s = -14dB/1 MHz.

The digital voltmeter must show a voltage of U = 1.5V ± 0.1V

Set the level oscillator to f = 18 MHz. With L1 adjust to the value previously measured at 1 MHz.

Now connect the digital voltmeter to pins 15 and 12 and set the transmit level of W2007 to ps = -34 dB/1 MHz.

The digital level meter should show a voltage of U = 1.5V ± 0.1V.

Set the level oscillator to f = 18 MHz. With L2 adjust to the value previously measured at 1 MHz.

With the same transmit level as before, i.e. p_s = - 34 dB check the voltage at pin 15 and 13 (with the digital voltmeter) in the frequency range 6 kHz to 18.6 MHz)

nominal value U = 1.5 V ± 0.1V

4.6.17.4.1 Adjusting the threshhold voltages

This adjustment is best done in the level meter.

In accordance with the following instructions adjust the threshhold voltages i.e. the limits at whilst the overload indication must operate.

Inject a signal of p = 0dBm/-10 dB 75 coaxial, f = 1 MHz into the level meter D2007 B...

Setting at level meter p = 0 dB/-10 dB
z = 75 Ohm/coaxial
f = 1 MHz
bandwidth 1.74 kHz
AFC on, low distortion

Now increase the sensitivity of the D2007 by 70 dB to -70 dBm/ -80 dB and increase the transmit level by 6 dBm/7 dB (also p_s = +6 dBm/-3dB)

Indicator lamp Lp 2 and Lp3 should light up. Now turn potentiometer R61 of subassembly D5296 to the left until Lp3 is extinguished then turn R61 to the right **until Lp 3 just lights again.**

Reduce the sensitivity of the D2007 from the previous measurement by 20 dB to -50dBm/-60 dB (transmit level p_s = +6 dBm/-3dB) only Lp2 should now be alight.

Now reduce the transmit level until lamp **Lp 2** is extinguised. The transmit level should then be ps $\geq$ + 5.2 dBm/-3.8 dB.

4.6.18 Calibrate Generator D5297

This subassembly supplies a highly constant level for calibration of the level meter itself and a probe connected to the level meter.

4.6.18.1 Test Equipment and Accessories required.

1 level oscillator e.g. W2007 or W/G 2021
1 level meter e.g. D2007 or W/G 2021
1 sweep attachment G2022.
1 sweep oscillator 2 G2026 or G2024
1 level tracer D2001 with wide band amplifier plug in D917, 918, or 922
1 oscilloscope e.g. Siemens **oscillar M214**
2 **/uA multimeters**
1 DC power supply, stabilised 14V
1 MHz oscillator -D5276-; tested
1 potentiometer, 2.5 Kohm
1 resistor 75 Ohm $\pm$ 2%

4.6.18.2 Current Consumption and DC Voltage

Connect the subassembly, without any signal at its input with pin 13/14 to a DC power supply (U- = 14V ± 0.1V) via a µA multimeter (100 mA ramge).

Current Consumption

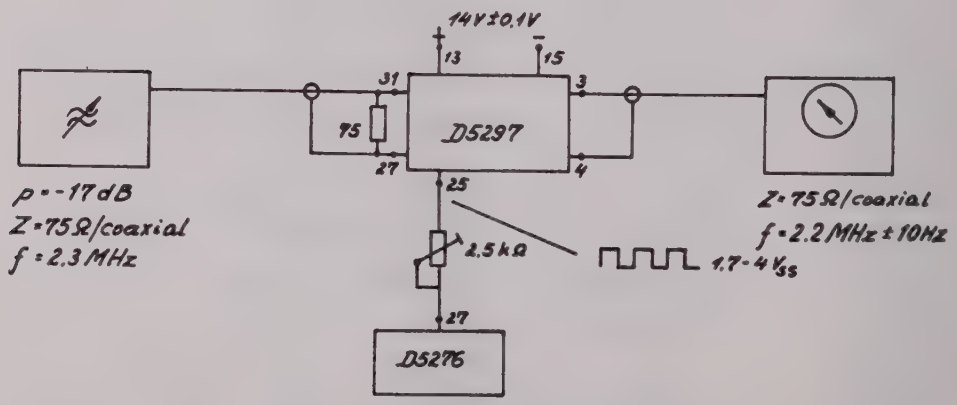
$$Jo = 34 \text{ mA} \pm 4 \text{ mA}$$

The following DC voltages are to be checked (against chassis pin 15/16) with a digital voltmeter or a µA multimeter.

U(V)	Ts1	Ts2	Ts3	Ts4	Ts5	Ts6	Ts7
U_C	0	1.3-1.7	7.3-8.7	10.3-11.9	11.2-13.2	12.7-14.0	12.7-14.0
U_B	1.3-1.7	0.4-0.8	2.2-2.6	1.7- 2.1	10.5-11.7	3.5-4.1	6.0-7.2
U_E	1.4-1.8	0	1.6-2.0	1.1-1.5	3.4-4.0	2.9-3.5	5.4-6.6

Measuring point 2: approx 6.7 V
Measuring point 3: 6.45 - 7.15V
Measuring point 4: 13.0 - 14.0V

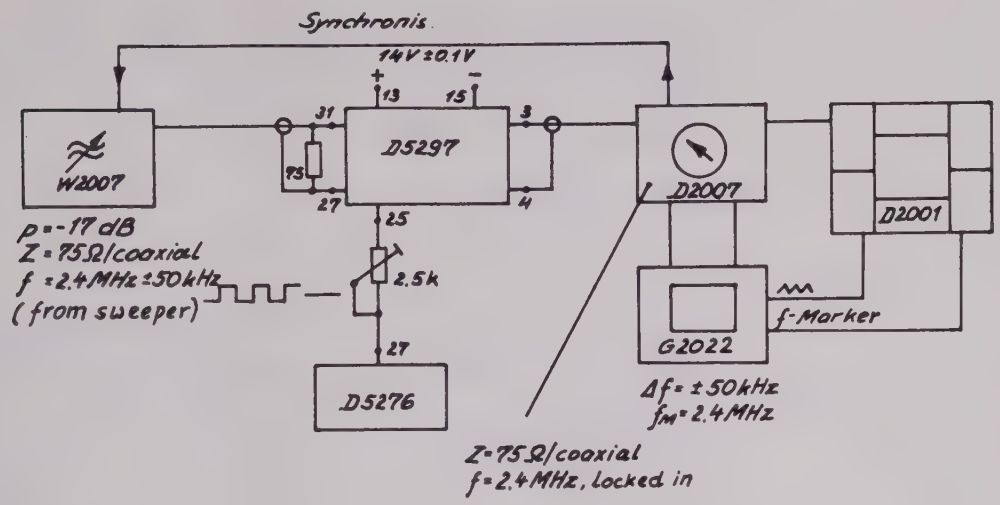
4.6.18.3 Checking the pole attenuation



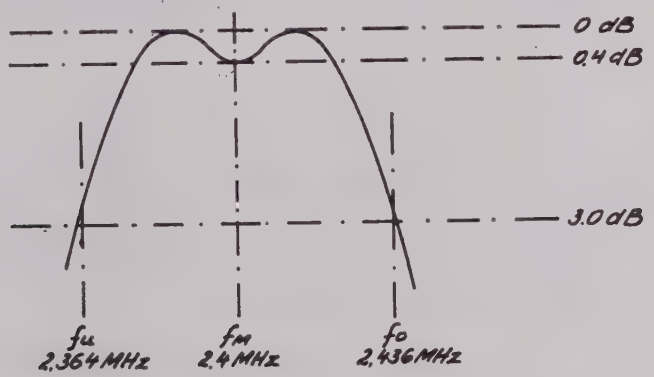
The pole attenuation at f = 2.2 MHz (indication on the level meter) is to be checked. The indication on the level meter should be less than - 85 dB

$$P_{2.2} < -85 \text{ dB}$$

4.6.18.4 Adjusting the pass band of the 2.4 MHz band pass filter



Set R19 in the subassembly -D5297- to its right hand stop. In accordance with the test set up, adjust the pass band of the 2.4 MHz curve by means of U1 and U2 (not L2)



The pass band should be symmetrical **about the centre frequency and** any variations should be less than 0.4 dB (a = 0.4 dB). The 3dB bandwidth should be 72 to 75 kHz.

Hints on adjustment

Turning slug of U1 inwards,	left bump increases
Turning slug of U1 outwards,	left bump decreases
Turning slug of U2 inwards,	left bump decreases pass band is shifted to the left
Turning slug of U2 outwards,	right hand bump decreases pass band is shifted to the left.

4.6.18.5 Adjusting the carrier basic attenuation

With the level meter in the test set up as shown in 4.6.18.2 set frequency to f = 2.3 MHz, and tune to maximum indication. With potentiometer R19 of subassembly -D5297- set the level meter to minimum deflection

$$p \leq -80dB$$

4.6.18.6 Adjusting the calibrate level

Setting of the calibrate level is made, as described in 3.4 (maintenance) by means of potentiometer R68.

4.6.18.7 Adjusting the probe calibrate level

Adjusting the probe calibrate level is made in the following manner:-

The level meter is to be calibrated in the expanded scale mode. (Set pointer of instrument exactly to the ▼ mark on the lower scale).

Ther connect the input connector Bu 1 via short wire with the probe calibrate connector Bu3, operate the switch contact in the probe power supply connector Bu4, (plug connector into socket). Set Z switch into position coaxial - high impedance) expanded scale remains switched on , now push the calibrate button T1.

Adjust R88 of subassembly D5297 so that the instrument pointer is again exactly on the ▼ mark of the lower scale.

4.6.18.8 Distortion Attenuation of the Subassembly

In accordance with the test set up of 4.6.18.5 set the maximum distortion attenuation with potentiometer R37 (smallest indication at level meter - low distortion at 4.8 and 7.2 MHz).

$P_{ak2} \leq -98$ dB $\triangleq ak_2 \geq 48$ dB at 4.8 MHz receive frequency

$P_{ak3} \leq -98$dB $\triangleq ak_3 \geq 48$ dB at 7.2 MHz receive frequency

4.6.19 Indicator Logic D5298

By means of this subassembly the value dependent upon the settings influencing the overall amplification of the level meter D2007 (range switch, scale expander, impedance switch, operating mode) is indicated.

Attention! Do not apply a voltage greater than 5.5 V to the power supply of the integrated circuits!!!

4.6.19.1 Current consumption

Via a uA multimeter each apply a DC voltage U1 = +5 ±0.1 V at pin2/3 pin 2/3 of the 31 pole connector against chassis (pin 1/31) and at pin 19 U2 = +180 V ±3 V against chassis.

The current flowing in the 5V branch should have a nominal value of

Io = 200 to 240 mA

The current flowing in the 180V branch, with an indication of -110 should be

Jo = 7.7 to 8.7 mA

In accordance with the following table, with the supply voltages, U = 5V ± 0.1V and U2 = 180V ± 5V applied to the pins of the 31 pole connector, connect either +5 V ±0.1 V (shown as L) or chassis (shown as 0). The indicator tubes must then show the numbers given in the table. The test points for fault finding are also given in the table.

31 pole connector

Indication	x) 1/31	xx) 2/3	4	5	6	8	10	11	12	13	14	15	16	17	18	20	21	22	23	24	25	26	27	28	29	30
+ 20	0	1	1	0	0	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
+ 10	0	1	1	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
- 10	0	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
- 20	0	1	1	0	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
- 30	0	1	1	0	0	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
- 40	0	1	1	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
- 50	0	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
- 60	0	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
- 70	0	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
- 80	0	1	1	0	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
- 90	0	1	1	0	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
-100	0	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
-110	0	1	1	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
+ 9	0	1	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
+ 8	0	1	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
+ 7	0	1	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
+ 6	0	1	1	0	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
+ 5	0	1	1	0	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
+ 4	0	1	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
+ 3	0	1	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
+ 2	0	1	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
+ 1	0	1	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
- 1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1
- 9	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0
off	0	1	1	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
off	0	1	0	0	0	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1

x) chassis

xx) +5V- power supply of the subassembly.

Indication	Soldering pin (measuring point)																								
	32	33	34	35	36	38	40	42	44	45	51	52	53	54	56	58	59	60	61	62	63	64	65	66	67
+ 20	L	0	L	L	0	L	L	L	L	0	0	0	L	0	L	0	0	0	0	L	0	0	0	0	0
+ 10	0	L	L	L	L	L	L	L	L	0	0	0	L	0	L	0	L	0	0	0	0	0	0	0	0
0	L	L	L	L	0	0	0	0	0	L	L	L	L	0	L	L	0	L	L	0	0	0	0	0	0
- 10	0	0	0	0	L	0	0	0	0	L	L	0	L	0	L	0	L	0	0	0	0	0	0	0	0
- 20	L	0	0	0	0	L	0	0	0	L	L	0	L	0	L	0	0	0	0	L	0	0	0	0	0
- 30	0	L	0	0	L	L	0	0	0	L	L	0	L	0	L	0	L	0	0	L	0	0	0	0	0
- 40	L	L	0	0	0	0	L	0	0	L	L	0	L	0	L	0	0	0	L	0	0	0	0	0	0
- 50	0	0	L	0	L	0	L	0	0	L	L	0	L	0	L	0	L	0	L	0	0	0	0	0	0
- 60	L	0	L	0	0	L	L	0	0	L	L	0	L	0	L	0	0	0	L	L	0	0	0	0	0
- 70	0	L	L	0	L	L	L	0	0	L	L	0	L	0	L	0	L	0	L	L	0	0	0	0	0
- 80	L	L	L	0	0	0	0	L	0	L	L	0	L	0	L	0	0	L	0	0	0	0	0	0	0
- 90	L	L	L	0	L	0	0	L	0	L	L	0	L	0	L	0	L	L	0	0	0	0	0	0	0
-100	0	L	L	0	0	L	0	L	0	L	L	0	L	0	0	0	0	0	0	0	0	0	0	0	0
-110	L	L	L	0	L	L	0	L	0	L	L	0	L	0	0	0	L	0	0	0	0	0	0	0	0
+ 9	0	L	L	L	L	L	L	L	L	0	0	0	L	0	L	L	0	L	L	0	0	0	0	L	L
+ 8	0	L	L	L	L	L	L	L	L	0	0	0	L	0	L	L	0	L	L	0	0	0	0	L	0
+ 7	0	L	L	L	L	L	L	L	L	0	0	0	L	0	L	L	0	L	L	0	0	L	L	0	L
+ 6	0	L	L	L	L	L	L	L	L	0	0	0	L	0	L	L	0	L	L	0	0	L	L	0	0
+ 5	0	L	L	L	L	L	L	L	L	0	0	0	L	0	L	L	0	L	L	0	0	0	L	0	L
+ 4	0	L	L	L	L	L	L	L	L	0	0	0	L	0	L	L	0	L	L	0	0	0	L	0	0
+ 3	0	L	L	L	L	L	L	L	L	0	0	0	L	0	L	L	0	L	L	0	0	L	0	0	L
+ 2	0	L	L	L	L	L	L	L	L	0	0	0	L	0	L	L	0	L	L	0	0	L	0	0	0
+ 1	0	L	L	L	L	L	L	L	L	0	0	0	L	0	L	L	0	L	L	0	0	0	0	0	L
- 1	L	L	L	L	0	0	0	0	0	L	L	0	L	0	L	L	0	L	L	0	0	0	0	0	L
- 9	L	L	L	L	0	0	0	0	0	L	L	0	L	0	L	L	0	L	L	0	0	0	0	L	L
off	L	0	L	L	0	L	L	L	L	0	L	L	L	0	L	L	L	L	L	0	L	0	L	L	0
off	L	0	L	L	L	0	L	L	L	0	0	L	L	0	L	L	0	L	L	L	L	0	L	L	0

4.6.20 Power Supply -D5301-

At the output of the power supply the three DC voltages, +5 +14 and +18V are available for the supply of the subassembly (See also fault locating plan No.1 page 4-6).

The power supply remains connected to the D2007 during the test i.e. loaded, (the wires to the subassemblies Tp1, Tp2 and Tp3 remain connected.

4.6.20.1 Measuring Equipment required

1 digital voltmeter
1 UA multimeter
1 DC power supply 12 to 50V
1 load resistor R_{L1} = 22 K Ohm ± 5%, 2W
1 load resistor R_{L2} = 22 K Ohm ± 5%, 15W
1 load resistor R_{L3} = 20 Ohm ± 5% 2W

necessary test is carried out outside D2007.

4.6.20.2 Checking the No load voltage

Break the connection C13 - soldering pin 1 (on the DC/DC converter), set the voltage selector in the mains socket to 220V and switch the instrument on (with S10). If testing **outside the D2007 the soldering lugs on strip b of the** the transformer are to be bridged (replacement for mains switch) **Further check if the fuse is fitted for 220 V mains operation (ie. 0.315 A).**

Apply **an** AC voltage of U~=220V to the mains socket Bu10 and measure with a µA multimeter the no load voltage **on** C8 against C13.

nominal value U- = 40V ± 3V

4.6.20.3 Checking the voltage at C8 - C13 under load.

Withdraw the plug from socket "Bu 10" (no voltage at Bu 10) replace the connections C13 - soldering pin 1. The output of power supply (Tp1, 2 and Tp3) must be under load.

The mains voltage U = 220 is to be reconnected via a AC current multimeter to socket "Bu 10". Now check the voltage at C8 against C13

nominal value U⎓ = +32V ± 3V

The AC current multimeter should show a current of $I\sim$ = 120 mA ± 15mA.

4.6.20.4 Checking the output voltages

With the mains connected U = 220V and the outputs under load (Tp 1, 2, 3) measure the output voltages with a digital voltmeter and readjust if necessary.

nominal value

at TP3 - +5V ± 0.2V (if necessary readjust with R17 in the DC/DC converter)

at TP2 - +14V ±0.05V (adjust with R25 in the DC/DC converter)

at Tp3 - +170V to 220V

4.6.20.5 **Checking battery operation**

U_E = +12V - and U_E = +48V-

via a µA multimeter apply a voltage of U_E = 12V_ to connector Bu 11. (+ to pin 2 and-to pin 1 of the connector). The output voltages at Tp1, 2 and 3 must be the same as in 4.6.20.4. The current indicated by the multimeter should be

$$I_{12} = 1.5 \text{ to } 2.0 \text{ A}$$

(with AFC and lock in lamps on)

When the input voltage at Bu 11 is increased to U_E = +48 V the output voltages should be the same as in 4.6.20.4. The current indicated by the multimeter must drop to

$$I_{48} = 0.35 \text{ to } 0.5\text{A}$$

4.6.20.6 With a µA multimeter and an input voltage of U∼=220V check the following DC voltages against soldering pin 1 (on board D5302) **or against Duco C13.**

U(V)	Ts2	Ts3	Ts4	Ts5
U_C	29-31	-1.0 bis -5.0	0.2-0.8	18.0-24.0
U_B	24-30	18.0 - 23.0	-1.0 bis -5.0	18.5-24.0
U_E	23-29	19.0 - 24.0	-1.5 bis -5.5	19.5-25.0

U(V)	Ts6	Ts7
U_C	1,5 bis -5,5	29-31
U_B	-2,0 bis -6,0	-1,5 bis -5,5
U_E	-1,5 bis -5,5	0

Ts1: U_D = 19,0 -23,0V
U_G = 0 -1,0 V
U_S = 0,5 - 3,5V

J1: U_1 = 17,2 - 18,0V
U_2 = 13,9 - 14,1V
U_3 = 8,8 - 9,2V

(measured at J1 against chassis)

4.6.21 Level Matrix -D5303-

4.6.21.1 Measuring equipment required

1 µA multimeter
1 DC power supply +14V

4.6.21.2 Function testing of type D5303-A701

In accordance with the following table apply +14V ± 1V (shown in the table as L) to the pins of the 31 pole connector indicated. Then check with a µA multimeter the remaining pins of connector I and II (voltage or no voltage)

apply voltage to pin of connector II	pin	Measure voltage at pin — Connector II																									Connector I												
		2	3	4	5	6	7	8	9	11	12	13	14	15	17	18	19	22	23	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	10	11	12	13
2		L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	L	L	0	0	L	L	0	0
3		0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0
4		0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0
5		0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	L
6		0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L
7		0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	L
8		0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	L	0	0	0	0	L	0	0	0
9		0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	L	0	0	0	0	L	0	0	0
11		0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	L
12		0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	L	0	0	0	L
13		0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	L
14		0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	0	L	0	0	0
15		0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	0	L	0	0	0
17		0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	L	0	0	L
18		0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	L	0	0	0	L
19		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	L
22		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	L	0	0	L	0	0	0	0	L	0	0	0
23		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	L	0	L	0	0	0	L	0	0	0	0
25		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	L	0	0	L	0	L	0	0	0
26		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	L	0	0	L	L	0	0	0	0
27		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	L	0	0	0	0	0	0	L	0	0	L
28		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	L	L	0	0	L	0
29		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	L	0	0	0	0	0	0	L	0	L	0
30		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	L	0	0	0	0	0	0	L	0	0	L	0
31		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	L	0	L	0	L	0

4.6.21.3 Function Test -D5303-B701

In accordance with the following table apply +14V ± 1V (shown in table as L) to the pins of the 31 pin connector indicated, Thereupon check with a A multimeter the remaining pins of connector I and II (voltage or no voltage).

| apply voltage to pin of connector II | Measure Voltage at pin | | |

4.6.22 2.4 MHz Buffer Amplifier -D5304-

4.6.22.1 Measuring Equipment Required

1 HF multimeter
1 µA multimeter

4.6.22.2 Current consumption

Connect the subassembly via a µA multimeter (10 mA range) to the 14V supply voltage. The current consumed by the subassembly should be

$$Io = 2.5 \text{ mA} \pm 0.2 \text{ mA}$$

4.6.22.3 Checking the Amplification

With a HF multimeter check the HF voltage at the input (soldering pins 3 against chassis) and output (soldering pin 2 against chassis)

Both voltages should be approximately equal ($\pm$ 5 mV)- ie. approximately 120 mV.

Vorbemerkung

Unter Symbol stehen die in den Stromläufen verwendeten Abkürzungen für die Bauteile in alphabetischer und - soweit möglich - in numerischer Reihenfolge. Mit Stück ist die Anzahl der gleichen Bauteile innerhalb der Geräte oder der Baugruppe bezeichnet. In der Spalte Gegenstand sind außer dem Namen des Bauteils auch seine Hauptkennwerte angegeben. Mit der Bestellangabe ist das Bauteil durch einen Abkürzungs-Code oder eine Bauvorschrift eindeutig gekennzeichnet.

Es bedeuten:

bei einem Widerstand:	300kΩ ±5%; 0,5W
300kΩ	Nennwert des Widerstandes
±5%	Toleranz des Nennwiderstandes
0,5W	Belastbarkeit bezogen auf Umgebungstemperatur 20°C
bei einem Kondensator:	1000pF ±20%; 125V-
1000pF	Nennwert der Kapazität (1pF=1µµF=10^{-12}F)
±20%	Toleranz der Nennkapazität
125V-	zulässige Betriebsgleichspannung

bei einem Übertrager:

Wicklg. I (1a,2a,3a)	Wicklg.II (rtsw,gesw, rtgn,gegnsw)+
440 Wdg 0,1 CuL 75Ω	720 Wdg HFL SS 60x0,03
228µH ±2%	35Ω
Abgriff(2a):210 Wdg	1.Abgriff(gesw): 46 Wdg
	2.Abgriff(rtgn):190 Wdg

Wicklg. I (1a,2a,3a)	
440 Wdg	440 Windungen, Anfang Lötöse 1a, Ende 3a;
0,1 CuL	aus Kupferdraht (Cu): 0,1mm ∅; lackisoliert (L)
75Ω	Gleichstromwiderstand der Wicklung I
228µH	Induktivität
Abgriff(2a):210 Wdg .	Abgriff bei der 210. Windung, Lötöse 2a
Wicklg. II	sinngemäß wie bei Wicklung I
HFL SS 60x0,03 . . .	Hochfrequenzlitze 2fach seidenumsponnen (SS), aus Kupferdraht 60x0,03mm ∅
bei einem Gleichrichter:	50V / 250mA
50V	Anschluß-Wechselspannung
250mA	entnehmbarer Betriebsstrom

bei Halbleitern:

J_D	Durchlaßstrom bei +1V	Dioden
U_{Sp}	Sperrspannung	Dioden
J_Z	Zenerstrom	Zenerdioden
U_Z	Zenerspannung	Zenerdioden
r_Z	Dynamischer Zener-Widerstand bei J_Z	Zenerdioden
R_{20}	Widerstand bei 20°C z.B. von Heißleiterm	Zenerdioden
TK	Temperaturkoeffizient	Zenerdioden

+Farb-Kurzzeichen

bl = blau	ge = gelb	gr = grau	sw = schwarz	rs = rosa
br = braun	gn = grün	rt = rot	ws = weiß	rtsw = rot/schwarz

Introductory remark

The "SYMBOL" column shows the abbreviations used in the circuit diagrams in alphabetic and, to the ectent possible, numerical order. "QTY" denotes the number of identical components within the devices or the subassembly. The "DESCRIPTION" column gives, apart from the designation of the components, its principal characteristic data. The "ORDERING DATA" column designates the component nonambiguously by an abbreviation code or a component specification.

There denotes, for instance

with a resistor:	300 kΩ ±5%; 0,5W
300 kΩ	Nominal value of the resistance
±5%	Tolerance of the nominal resistance
0,5 W	Wattage rating, as referred to an ambient temperature of 20°C

with a capacitor:	1000 pF ±20%; 125V-
1000pF	Nominal value of the capacitance (1pF=1µµF=10^{-12}F)
±20%	Tolerance of the nominal capacitance
125V-	Permissible DC operating voltage

with a transformer:	Wicklg. I (1a,2a,3a)	Wicklg. II (rtsw,gesw, rtgn,gegnsw)+
	440 Wdg 0,1 CuL 75Ω	720 Wdg HFL SS 60x0,03 35Ω
	228µH ±2%	1.Abgriff(gesw): 46 Wdg
	Abgriff(2a): 210 Wdg	2.Abgriff(rtgn): 190 Wdg

Wicklg. I(1a,2a,3a)	
440 Wdg	440 turns, start soldering lug 1a, end 3a
0,1 CuL	of copper wire (Cu); 0.1 mm dia., enamelled (L)
75Ω	DC resistance of winding I
228µH	Inductance
Abgriff(2a):210 Wdg	Tap at soldering lug 2a at the 210th turn
Wicklg. II . . .	Analogogously to winding I
HFL SS 60x0,03 .	RF copper Litz wire, with double silk covering, 60x0.03 mm dia.

with a rectifier:	50V / 250mA
50V	Primary AC voltage
250mA	Available operating current

with semiconductors:

J_D	Forward current with +1 v	Diodes
U_{Sp}	Inverse voltage	
J_Z	Zener current	Zener diodes
U_Z	Zener voltage	
r_Z	Dynamic Zener resistance at J_Z	
R_{20}	Resistance coefficient	

+Color symbols

bl=blue	ge=yellow	gr=gray	sw=black	rs	=	pink
br=brown	gn=green	rt=red	es=white	rtsw	=	red/black

Pegelmesser 6 kHz - 18,6 MHz S45034-D2007-B,C102;B,C204
LEVEL METER 6 kHz - 18,6 MHz

Ausführung -D2007-B,C102: dB -Eichung, MODEL dB -CALIBRATION
Ausführung -D2007-B,C204: dBm-Eichung, MODEL dBm-CALIBRATION

Symbol SYMBOL	Stck QTY	Gegenstand DESCRIPTION	Bestellangabe ORDERING DATA	Seite PAGE
für Ausf. FOR MODEL				
1	1	f1-Oszillator f1-OSCILLATOR	S45035-D5272-B701	
1	1	1-MHz-Oszillator 1-MHz-OSCILLATOR	S45035-D5276-B701	
1	1	Filter/Verstärker FILTER/AMPLIFIER	S45035-D5277-B701	
1	1	f2-Oszillator f2-OSCILLATOR	S45035-D5278-B701	
1	1	f3-Oszillator f3-OSCILLATOR	S45035-D5281-B701	
1	1	Phasmod/Suchosz PHASE MOD/ SEARCH FREQ OSC	S45035-D5282-A701	
1	1	Meßfeld INPUT SUBASSEMBLY	S45035-D5283-B301	
1	1	10x1-dB-Teiler DIVIDER	S45035-D5287-A101	
1	1	Modulator 1 MODULATOR 1	S45035-D5288-B701	
1	1	Modulator 2 MODULATOR 2	S45035-D5289-A701	
1	1	Modulator 3 MODULATOR 3	S45035-D5290-B701	
1	1	80-Hz-Quarz-Bandpaß CRYSTAL BAND-PASS FILTER	S45035-D5291-B701	
1	1	1,74-kHz-Filter BAND PASS FILTER	S45035-D5150-B711	
1	1	100-kHz-Vorverst. PREAMPLIFIER	S45035-D5293-B301	
1	1	100-kHz-Endverst. FINAL AMPLIFIER	S45035-D5294-A701	
1	1	Meßkreisplatte MEAS CIRCUIT	S45035-D5295-B701	
1	1	AFC- und Overload-Pl AFC-/OVERLOAD-BOARD	S45035-D5296-A701	
1	1	Eichgenerator CAL GENERATOR	S45035-D5297-B701	
1	1	Anzeigelogik DISPLAY LOGIC	S45035-D5298-B701	
1	1	Verdrahtungsplatte BASE PLATE	S45035-D5300-B701	
1	1	Netzteil POWER SUPPLY UNIT	S45035-D5301-B701	
1	1	Pegelmatrix LEVEL MATRIX	S45035-D5303-A701	
1	1	Trennverstärker BUFFER AMPLIFIER	S45035-D5304-A701	
		Schichtwiderstand LAYER-TYPE RESISTOR		
R1 1	1	1,5kOhm 5% 0,15W	B51262-A2152-J	
R4 1	1	3,0kOhm 5% 0,15W	B51262-A2392-J	
R5 1	1	10kOhm 5% 0,15W	B51262-A2103-J	
R6 1	1	2,5kOhm 5% 0,15W	B51262-A2252-J	
		Drehwiderstand VAR RESISTOR		
P1 1	1	1kOhm 20% lin	W40954-B8102-M1	
P3 1	1	10kOhm 20% lin	W40101-E8103-M1	
		Tantal-Elko TANTAL ELECTROLYTIC CAP		
C1 1	1	2,2/uF 20% 20V	B45170-A3225-M	
		Diode DIODE		
Gr1,2 2	2	BAW 75	Q62702-A396	
		Relais RELAY		
A1,2 2	2		V23162-A721-B104	
A3 1	1		V23162-B720-B129	
		Drehspulinstrument MOVING COIL INSTRUMENT		
J 1	1	100/uA lin	V70349-A578-A11	
		Signallampe SINGAL LAMP		
Lp2,3,5 3	3	16V 0,5W	C44230-Z3-C24	
Lp1,4 2	2	16V 0,5W	C44230-Z3-C26	
		Schalter SWITCH		
S4,8 2	2		C26315-Z23-C9	
S5 1	1		C26315-Z23-C14	
S6 1	1		C26315-Z23-C17	
S7 1	1		C26315-Z23-C4	
S9 1	1		C26315-Z23-C20	
S10 1	1		C22315-Z1-C8	
T1 1	1	Drucktaste PUSHBUTTON	C26315-Z23-C57	
Bu8 1	1	Einbaubuchse COAXIAL JACK	C42334-A76-A36	
Bu13 1	1	Buchseneinheit JACK UNIT	C42334-A12-A1	
Bu4 1	1	Schaltbuchse SWITCH CONTACT JACK	C44334-Z23-C1	
		Drehschalter TURN SWITCH		
S1 1	1		V42265-A124-B111	
S2 1	1		V45265-A124-B91	
		Drehknopf KNOB		
2	2	für f1,2 FOR F1,2	H60501-A1040-X1	
2	2	für f1,2 FOR f1,2	C44106-Z8-C2	
1	1	für P1 FOR P1	C44106-A1-A2	
		Knebelknopf SWITCH KNOB		
1	1	für S1 FOR S1	H60502-A631-A1	
2	2	für S2,3 FOR S2,3	H60502-A623-A1	
		Deckel COVER		
1	1	für f1,2 FOR f1,2	C44106-Z8-C4	
1	1	für S1 FOR S1	H60502-T31-G	
2	2	für S2,3 FOR S2,3	H60502-T23-G	
1	1	Netzleitung POWER CORD	V45594-F4-A322	
1	1	Batterieleitung BATTERY CORD	V45257-R3003	
		Leitung CORD		
Le1 1	1		V42251-C310-U102	
Le2 1	1		V45251-C179-U102	
Le3 1	1		V45251-F3004-A1	
Le4 1	1		V44251-F3016-A1	
Le5 1	1		V45251-F3004-A7	
Le6 1	1		V42251-C336-U103	
Le7 1	1		V45251-F3004-A6	
Le8 1	1		V44251-C3049-A1	
Le9 1	1		V44251-W3004-A1	
2	2	Verbindungsstecker CONNECTING PLUG	C42334-A81-A30	
		Sicherung FUSE		
1	1	315 mA	D41571-M315-C2	
2	2	630 mA	D41571-M630-C2	
1	1	Kappe BUTTON für T1 FOR T1	C26315-Z23-C38	
1	1	Abdecklinse CLEAR PLASTIC CAP für P3 FOR P3	C42230-A4-C2	

f1-Oszillator S45035-D5272-B701
f1-OSCILLATOR

	1	Oszillator OSCILLATOR	S45035-D5273-B701
	1	Trennverstärker BUFFER AMPLIFIER	S45035-D5274-B701
	1	Filmantrieb FILM-SCALE DRIVE	C44106-A7-A4
		Schichtwiderstand LAYER-TYPE RESISTOR	
R71	1	1,5kOhm 5% 0,15W	B51262-A2152-J
		Tantal-Elko TANTAL ELECTROLYTIC CAP	
C41	1	15/uF 20% 20V	B45170-A3156-M
		Duko LEAD THROUGH CAPACITOR	
C43	1	1000pF 20% 500V	B37481-B5102-R
C44,45,46	3	5000pF 20% 500V	B37481-B5502-R
		Drehkondensator VAR CAPACITOR	
C13	1	9...117pF	V45246-Z3004-A1
		Spule COIL	
L4,5,10	3	40/uH 0,2A	B82501-A-C7
		Ringkernspule TOROIDAL CORE COIL	
L7	1		V44237-K3012-A1
L8	1		V44237-K3012-A5
L9	1		V44237-K3012-A3

Oszillator S45035-D5273-B701
OSCILLATOR

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1,4	2	330 Ohm 5% 0,15W	B51262-A2331-J
R2	1	18 Ohm 5% 0,15W	B51262-A2180-J
R3,15	2	1,2kOhm 5% 0,15W	B51262-A2122-J
R5,23	2	27 Ohm 5% 0,15W	B51262-A2270-J
R8	1	100 Ohm 5% 0,15W	B51262-A2101-J
R9,10	2	8,2kOhm 5% 0,15W	B51262-A2822-J
R11	1	22kOhm 5% 0,15W	B51262-A2223-J
R12,25	2	220 Ohm 5% 0,15W	B51262-A2221-J
R16	1	47 Ohm 5% 0,15W	B51262-A2470-J
R17,18	2	620 Ohm 5% 0,15W	B51262-A2621-J
R19	1	68 Ohm 5% 0,15W	B51262-A2680-J
R22	1	4,7kOhm 5% 0,15W	B51262-A2472-J
R24	1	3,3kOhm 5% 0,15W	B51262-A2332-J
R26	1	47kOhm 5% 0,15W	B51262-A2473-J
R29	1	8,2kOhm 5% 0,15W	B51262-A2822-J
R30	1	5kOhm 0,5W lin	C44408-Z4-C9
	1	Übertrager TRANSFORMER	V45237-L3010
		Keramik-Spule CERAMIC COIL	
L1	1	407 nH	V44233-Z3002
		HF-Drossel RF CHOKE	
L2,3	2	47/uH	C44330-Z5-C3
		Keramik-Kondensator CERAMIC CAPACITOR	
C1,2,17, 25	4	3300pF 20% 500V	B37632-B5332-R3
C3	1	47pF 1% NP0	B38522-A5470-F3
C4,5	2	120pF 1% NP0	B38222-S5121-F1
C8	1	12pF 2% NP0	B38522-A5120-G3
C9	1	5pF 0,5pF NP0	B38522-A5050-D3
C10	1	56pF 1% NP0	B38522-A5560-F3
C11	1	200pF 2% N150	B38222-S5201-G1
C12	1	200pF 1% NP0	B38222-S5201-F1
C15	1	2pF 0,5pF N750	B38266-J5020-D
C18,23	2	2000pF 20% 500V	B37638-B5202-R3
C19,22,24	3	2200pF 20% 500V	B37643-B5222-R3
		Thermo-Trimmer THERNEWID THERMISTOR	
C16	1	2,5pF	V45246-Z3003
		Kapazitätsdiode VARACTOR	
Gr1	1	BA 124/60	Q68000-A886-F2
		Diode DIODE	
Gr2,3	2	HP 5082-2800	Q62702-A284-F39
		Transistor TRANSISTOR	
Ts1..3	3	2 N 918	Q62702-F35
Ts4	1	BCY 58/IX	Q60203-Y58-J

Trennverstärker S45035-D5274-A701
BUFFER AMPLIFIER

		Schichtwiderstand LAYER-TYPE RESISTOR	
R31	1	82 Ohm 5% 0,15W	B51370-A2820-J
R32,33, 50,51	4	8,2kOhm 5% 0,15W	B51370-A2822-J
R36,52	2	68 Ohm 5% 0,15W	B51370-A2680-J
R37,53	2	47 Ohm 5% 0,15W	B51370-A2470-J
R38,54	2	910 Ohm 5% 0,15W	B51370-A2911-J
R40,58	2	620 Ohm 5% 0,15W	B51370-A2621-J
R43,59	2	36 Ohm 5% 0,15W	B51370-A2560-J
R44,60	2	4,7kOhm 5% 0,15W	B51370-A2472-J
R45,65	2	330 Ohm 5% 0,15W	B51370-A2331-J
R46,61	2	27 Ohm 5% 0,15W	B51370-A2270-J
R47,64	2	3,3kOhm 5% 0,15W	B51370-A2332-J
R39,57	2	220 Ohm 5% 0,15W	B51370-A2221-J
Ü2,3	2	Übertrager TRANSFORMER	V45237-L3010
		Spule COIL	
L6,11	2	40/uH 0,3A	B82501-A-A7
		Keramik-Kondensator CERAMIC CAPACITOR	
C28...33, 35...38	10	4700pF 20% 500V	B37632-B5472-R3
		Transistor TRANSISTOR	
Ts5..8	4	2 N 918	Q62702-F35

1-MHz-Oszillator S45035-D5276-B701
1-MHz-OSCILLATOR

		Schichtwiderstand LAYER-TYPE RESISTOR	
R7	1	160 Ohm 5% 0,5W	B51371-A2161-J
R3,4,5 17,37,66	6	100 Ohm 5% 0,25W	B54412-A2101-J
R10,45	2	39kOhm 5% 0,15W	B51262-A2393-J
R11,65	2	5,6kOhm 5% 0,15W	B51262-A2562-J
R12	1	200 Ohm 5% 0,25W	B54412-A2201-J
R15	1	2,2kOhm 5% 0,15W	B51262-A2222-J
R16	1	4,7 Ohm 5% 0,15W	B51262-A2040-J700
R18	1	10 Ohm 5% 0,25W	B54412-A2100-J
R19,24,32	3	150 Ohm 5% 0,25W	B54412-A2151-J
R20,25,26, 47,60	5	1,5kOhm 5% 0,15W	B51262-A2152-J
R23,80	2	680 Ohm 5% 0,15W	B51262-A2681-J
R31,67	2	300 Ohm 5% 0,25W	B54412-A2301-J
R29,30	2	75 Ohm 5% 0,25W	B54412-A2750-J
R33,50,51, 75	4	220 Ohm 5% 0,25W	B54412-A2221-J
R36	1	3,3kOhm 5% 0,15W	B51262-A2332-J
R38	1	1kOhm 5% 0,15W	B51262-A2102-J
R39	1	430 Ohm 5% 0,15W	B51262-A2431-J
R40	1	22kOhm 5% 0,15W	B51262-A2223-J
R43	1	2,7kOhm 5% 0,15W	B51262-A2272-J
R44	1	430 Ohm 5% 0,15W	B51262-A2431-J
R46	1	8,2kOhm 5% 0,15W	B51262-A2822-J
R52,59,71	3	390 Ohm 5% 0,15W	B51262-A2391-J
R53	1	820 Ohm 5% 0,15W	B51262-A2821-J
R54,58	2	12kOhm 2% 0,15W	B51262-A2123-G
R57	1	11kOhm 5% 0,15W	B51262-A2113-J
R61,81	2	110 Ohm 5% 0,25W	B54412-A2111-J
R64	1	10kOhm 5% 0,15W	B51262-A2103-J
R68	1	30 Ohm 5% 0,25W	B54412-A2300-J
R72	1	4,3kOhm 5% 0,15W	B51262-A2432-J

R74	1	3,3kOhm	5%	0,15W		B51262-A2332-J
R79	1	470 Ohm	5%	0,15W		B51262-A2471-J
R82	1	82 Ohm	5%	0,25W		B54412-A2820-J
R78	1	240 Ohm	5%	0,15W		B51252-A2241-J
		Drehwiderstand VAR RESISTOR				
R22	1	100 Ohm	10%	0,5W		C44408-Z4-C4
R73	1	1kOhm	10%	0,5W		C44408-Z4-C7
R55	1	20kOhm	10%	0,5W		C44408-Z4-C11
		Übertrager TRANSFORMER				
Ü1	1					V45231-F3025
Ü2	1					V45231-H3001-A1
Ü3	1					V45231-F3103
		HF-Drossel RF CHOKE				
L2	1	100/uH				C44330-Z5-C6
		Tantal-Elko TANTAL ELECTROLYTIC CAP				
C 5,6, 33	3	2,2/uF	20%	20V		B45170-J3225-M
C2	1	3,3/uF	20%	15V		B45170-J2335-M
C4	1	15/uF	20%	20V		B45170-J3156-M
C32	1	15/uF	20%	15V		B45170-J2156-M
		Styroflex-Kondensator STYROFLEX CAPACITOR				
C3	1	900pF	2%	63V		B31662-A5901-G
C38	1	180pF	5%	160V		B31861-A1181-J
		Keramik-Kondensator CERAMIC CAPACITOR				
C9,19	2	18pF	2%	NPO		B38222-A5180-G
C17,39	2	1000pF	20%	500V		B37638-B5102-R
C29	1	27pF	5%	NPO		B38222-A5270-J
C30,40,43, 44...47	7	1600pF	20%	500V		B37638-B5162-R
		MKM-Kondensator MKM CAPACITOR				
C12,22,24, 31	4	0,022/uF	20%	160V		B32435-A2223-M
C25,26,36, 37	4	0,056/uF	20%	160V		B32435-A2563-M
		MKL-Kondensator MKL CAPACITOR				
C16	1	0,68/uF	20%	25V		B32110-C3684-M
C18	1	0,47/uF	20%	25V		B32110-C3474-M
		Duko LEAD THROUGH CAPACITOR				
C15	1	1600pF	20%	500V		B37045-A5162-S2
		Lufttrimmer AIR DIELECTRIC TRIMMER				
C8	1	2,5...13pF				V42246-B1-A2
		Zenerdiode ZENER DIODE				
Gr3	1	BZX 55 B7 V5				Q62702-Z914
		Diode DIODE				
Gr2,5,6	3	HP 5082-2800				Q62702-A284-F39
		Transistor TRANSISTOR				
Ts1	1	BSX 62-16				Q60218-X62-D
Ts2,3,4, 8,9,10	6	BCY 58 /VIII				Q60203-Y58-H
Ts5,6,7, 11,12,13	6	2 N 918				Q62702-F35
		Quarz CRYSTAL				
Kr1	1	Q36/1MHz				Q83638-A1000-H
		Int. Schaltkr. INT. CIRCUIT				
J1	1	SN 7490 N				Q67000-J10-F9
J2	1	SN 74S00 N				Q67000-H662-F9

Filter/Verstärker S45035-D5277-B701
FILTER/AMPLIFIER

		Schichtwiderstand LAYER-TYPE RESISTOR				
R1	1	5,1kOhm	5%	0,15W		B51262-A2512-J
R2	1	5,6kOhm	5%	0,15W		B51262-A2562-J
R3	1	470 Ohm	5%	0,15W		B51262-A2471-J
R4	1	3kOhm	5%	0,15W		B51262-A2302-J
R5,45	2	910 Ohm	5%	0,15W		B51262-A2911-J
R8	1	82kOhm	5%	0,15W		B51262-A2823-J
R9,19	2	10kOhm	5%	0,15W		B51262-A2103-J
R10	1	4,3kOhm	5%	0,15W		B51262-A2432-J
R11,39	2	82 Ohm	5%	0,15W		B51262-A2820-J
R12,15	2	330 Ohm	5%	0,15W		B51262-A2331-J
R16	1	300 Ohm	5%	0,15W		B51262-A2301-J
R17	1	820 Ohm	5%	0,15W		B51262-A2821-J
R18	1	18kOhm	5%	0,15W		B51262-A2183-J
R22,36	2	4,7kOhm	5%	0,15W		B51262-A2472-J
R23	1	43 Ohm	5%	0,15W		B51262-A2430-J
R24,25	2	8,2kOhm	5%	0,15W		B51262-A2822-J
R26	1	200 Ohm	5%	0,15W		B51262-A2201-J
R29	1	1kOhm	5%	0,15W		B51262-A2102-J
R30	1	1,2kOhm	5%	0,15W		B51262-A2122-J
R31	1	120 Ohm	5%	0,15W		B51262-A2121-J
R32	1	150 Ohm	5%	0,15W		B51262-A2151-J
R33	1	27 Ohm	5%	0,15W		B51262-A2270-J
R37	1	3,3kOhm	5%	0,15W		B51262-A2332-J
R47	1	1,1kOhm	5%	0,15W		B51262-A2112-J
R48	1	680 Ohm	5%	0,15W		B51262-A2681-J
		Drehwiderstand VAR RESISTOR				
R46	1	200 Ohm	20%	lin		W40961-A8201-M1
Ü1	1	Übertrager Transformer				V45237-L3010
		Spule COIL				
L1	1					V45237-L3010
L2	1					V34231-F3104
		HF-Drossel RF CHOKE				
L3,4	2	100/uH	10%			C44330-Z5-C6
		Styroflex-Kondensator STYROFLEX CAPACITOR				
C1	1	530pF	2%	160V		B31861-A1531-G
C2	1	150pF	2%	160V		B31861-A1151-G
C3	1	1160pF	2%	160V		B31861-A1112-G600
C4	1	28pF	1pF	160V		B31861-A1280-F
C5	1	630pF	2%	160V		B31861-A1631-G
		Keramik-Kondensator CERAMIC CAPACITOR				
C6,23	2	6800pF	20%	60V		B37658-A6682-S3
C16,17	2	470pF	20%	500V		B37635-B5471-R
C18,19	2	10000pF	20%	60V		B37658-A6103-S3
C22	1	1600pF	20%	500V		B37638-B5162-R
		Tantal-Elko TANTAL ELECTROLYTIC CAP				
C8	1	3,3/uF	20%	15V		B45170-J2335-M
C9	1	15/uF	20%	20V		B45170-J3156-M
C11	1	6,8/uF	20%	6V		B45170-J685-M
C25	1	4,7/uF	20%	10V		B45170-J1475-M
		MKL-Kondensator MKL CAPACITOR				
C10	1	0,22/uF	20%	63V		B32110-E9224-M
C12,15	2	0,47/uF	20%	63V		B32110-E9474-M
		Zenerdiode ZENER DIODE				
Gr1	1	BZX 55 B10				V42292-H27-B
Gr4	1	BZX 55 A7 V5				V42292-H30-A2
		Diode DIODE				
Gr2,3	2	BAW 75				Q62702-A396
		Transistor TRANSISTOR				
Ts1,3,4	3	BCY 58/VIII				Q60203-Y58-H
Ts2	1	BCY 58/IX				Q60203-Y58-J
Ts5,6	2	2 N 918				Q62702-F35

f2-Oszillator S45035-D5278-B701
f2-OSCILLATOR

	1	Relaisplatte RELAY BOARD	S45035-D5275-B701
	1	Oszillator 2 OSCILLATOR 2	S45035-D5279-B701
	1	Trennverst. f3 BUFFER AMPLIFIER	S45035-D5280-B701
		Duko LEAD THROUGH CAPACITOR	
C24,25, 45,46	4	5000pF 20% 500V	B37481-B5502-R
C26	1	1000pF 20% 500V	B37481-B5102-R
C1	1	Drehkondensator VAR CAPACITOR	V45246-Z3004-A2
		Spule COIL	
L4,10	2	40 µH 0,2A	B82501-A-C7
		Ringkernspule TOROISAL CORE COIL	
L1	1		V44237-K3012-A4
L2	1		V44237-K3012-A6
L3	1		V44237-K3012-A3

Relaisplatte S45035-D5275-B701
RELAY BOARD

		MKM-Kondensator MKM CAPACITOR	
C1	1	0,1 µF 20% 100V	B32435-A2104-M
		Diode DIODE	
Gr1	1	BAW 75	Q62702-A396
A3	1	Relais RELAY	C44303-Z3-C26

Oszillator 2 S45035-D5279-B701
OSCILLATOR 2

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1	1	20kOhm 5% 0,15W	B51262-A2203-J
R2	1	75kOhm 5% 0,15W	B51262-A2753-J
R3,4	2	2kOhm 5% 0,15W	B51262-A2202-J
R5	1	560 Ohm 5% 0,15W	B51262-A2561-J
R8,11	2	100 Ohm 5% 0,15W	B51262-A2101-J
R9	1	5,6kOhm 5% 0,15W	B51262-A2562-J
R10	1	8,2kOhm 5% 0,15W	B51262-A2822-J
R12	1	27 Ohm 5% 0,15W	B51262-A2270-J
R15	1	1kOhm 5% 0,15W	B51262-A2102-J
R16	1	68 Ohm 5% 0,15W	B51262-A2680-J
R17	1	82 Ohm 5% 0,15W	B51262-A2820-J
R18	1	47 Ohm 5% 0,15W	B51262-A2470-J
R19	1	220kOhm 5% 0,15W	B51262-A2224-J
Ü1	1	Übertrager TRANSFORMER	V44231-C3253-A
		Keramik-Kondensator CERAMIC CAPACITOR	
C3,4	2	75pF 2% N075	B38471-J5750-G3
C5	1	20pF 2% N750	B38476-J5200-G3
C8	1	6pF 0,5pF NPO	B38522-A5060-D3
C9	1	6pF 0,5pF N750	B38526-J5060-D3
C9	1	4,7pF 0,5pF N750	B38526-J5040-D703
C9	1	12pF 5% N750	B38526-J5120-J3
C10	1	680pF 20% 500V	B37635-B5681-R
C8	1	4,7pF 0,5pF NPO	B38522-A5040-D703
C8	1	12pF 5% NPO	B38522-A5120-J3
		MKM-Kondensator MKM CAPACITOR	
C11,12,15 16,20	5	0,1 µF 20% 160V	B32435-A2104-M
C17	1	0,15 µF 20% 160V	B32435-A2154-M
C19	1	0,01 µF 20% 160V	B32435-A2103-M
		Tantal-Elko TANTAL ELECTROLYTIC CAP	
C18	1	10 µF 20% 20V	B45170-J3106-M

		Lufttrimmer AIR DIELECTRIC TRIMMER	
C2	1	2...31pF	C40208-Z130-A77
		Zenerdiode ZENER DIODE	
Gr1	1	BZX 55 C12	Q62702-Z684
		Diode DIODE	
Gr3,4,5	3	BAW 75	Q62702-A396
		Kapazitätsdiode VARACTOR	
Gr8,9	2	1 N 5456 A	Q62702-X88
		Transistor TRANSISTOR	
Ta1,2	2	BCY 58 VIII	Q60203-Y58-H

Trennverstärker f3 S45035-D5280-B701
BUFFER AMPLIFIER

		Schichtwiderstand LAYER-TYPE RESISTOR	
R32,33,50, 51	4	8,2kOhm 5% 0,15W	B51370-A2822-J
R39,57	4	220 Ohm 5% 0,15W	B51370-A2221-J
R37,53	2	47 Ohm 5% 0,15W	B51370-A2470-J
R38,54	2	910 Ohm 5% 0,15W	B51370-A2911-J
R40,58	2	620 Ohm 5% 0,15W	B51370-A2621-J
R43,59	2	56 Ohm 5% 0,15W	B51370-A2560-J
R44,60	2	4,7kOhm 5% 0,15W	B51370-A2472-J
R45,65	2	330 Ohm 5% 0,15W	B51370-A2331-J
R46,61	2	27 Ohm 5% 0,15W	B51370-A2270-J
R47,64	2	3,3kOhm 5% 0,15W	B51370-A2332-J
R36,52	2	68 Ohm 5% 0,15W	B51262-A2680-J
Ü2,3	2	Übertrager TRANSFORMER	V45237-L3010
		Keramik-Kondensator CERAMIC CAPACITOR	
C28...33, 35...38	10	4700pF 20% 500V	B37632-B5472-R3
C39	1	1500pF 20% 500V	B37638-B5152-R1
		Transistor TRANSISTOR	
Ta5,6,7,8	4	2 N 918	Q62702-P35

f3-Oszillator S45035-D5281-B701
f3-OSCILLATOR

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1	1	8,2kOhm 5% 0,15W	B51262-A2822-J
R2,5,27, 32,44	5	100 Ohm 5% 0,15W	B51262-A2101-J
R3,51	2	2,2kOhm 5% 0,15W	B51262-A2222-J
R4,54	2	330 Ohm 5% 0,15W	B51262-A2331-J
R16	1	680 Ohm 5% 0,15W	B51262-A2681-J
R17,18,19 20	4	150 Ohm 5% 0,15W	B51262-A2151-J
R23,26, 34,39	4	200 Ohm 5% 0,15W	B51262-A2201-J
R24	1	390 Ohm 5% 0,15W	B51262-A2391-J
R25,41	2	1,8kOhm 5% 0,15W	B51262-A2182-J
R30	1	3,3kOhm 5% 0,15W	B51262-A2332-J
R31	1	390 Ohm 5% 0,15W	B51262-A2391-J
R33	1	1,5kOhm 5% 0,15W	B51262-A2152-J
R37	1	10kOhm 5% 0,15W	B51262-A2103-J
R38,50	2	8,2kOhm 5% 0,15W	B51262-A2822-J
R40,47	2	220 Ohm 2% 0,15W	B51262-A2221-J
R45	1	15kOhm 5% 0,15W	B51262-A2153-J
R43	1	330 Ohm 5% 0,15W	B51262-A2331-J
R52,57	2	27 Ohm 5% 0,15W	B51262-A2270-J
R53	1	1,2kOhm 5% 0,15W	B51262-A2122-J
R58	1	56kOhm 5% 0,15W	B51262-A2563-J
R46	1	2,7kOhm 5% 0,15W	B51262-A2271-J
		Übertrager TRANSFORMER	
Ü1	1		V45231-F3033
Ü2	1		V45231-F3034
Ü3	1		V45237-L3010

		Spule COIL			
L1	1	40/uH	0,2A		B82501-A-C7
L2	1				V45231-F3035
L3	1	14/uH	0,5A		B82501-A-C5
		Drossel CHOKE			
L5	1	40/uH	0,2A		B82501-A-A7
		Keramik-Kondensator CERAMIC CAPACITOR			
C1,12,18, 26,29	5	1500pF	20%	500V	B37638-B5152-R3
C2	1	9pF	0,5pF	NP0	B38212-A5090-D3
C4	1	30pF	2%	N075	B38221-J5300-G3
C7,9	2	82pF	10%	500V	B37615-B5820-K1
C15	1	47pF	2%	NP0	B38222-A5470-G3
C16,43	2	1000pF	20%	500V	B37638-B5102-R3
C24	1	4700pF	20%	500V	B37632-B5472-R1
C25	1	6800pF	20%	500V	B37636-B5682-R1
C30	1	47pF	1%	NP0	B38222-A5470-F3
C31	1	120pF	1%	NP0	B38222-A5121-F3
C32	1	15pF	5%	NP0	B38222-A5150-J3
C37	1	47pF	2%	N150	B38222-J5470-G3
C38	1	80pF	1%	No75	B38221-J5800-F3
C38	1	75pF	1%	N075	B38221-J5750-F3
C40	1	33pF	2%	NP0	B38222-A5330-G3
		MKM-Kondensator MKM CAPACITOR			
C19,23	2	0,01/uF	10%	160V	B32435-A2103-K
		Duko LEAD THROUGH CAPACITOR			
C10,11,17 22,33,36	6	1600pF	20%	500V	B37046-A5162-Z2
		Lufttrimmer AIR DIELECTRIC TRIMMER			
C3,39	2	1,9...11pF			C40208-Z131-A12
		Transistor TRANSISTOR			
Ts1	1	BFX60			Q60206-X60
Ts3...7	5	2 N 918			Q62702-P35
		Zenerdiode ZENER DIODE			
Gr1	1	BZX 55 C6 V2			V42292_H26-A
		Diode DIODE			
Gr2	1	HP 5082-2800			Q62702-A284-F39
Gr3...6	4	BAW 75			Q62702-A396
Gr7	1	BA 124/60			Q68000-A886-F2
		Quarz CRYSTAL			
Kr	1	22,1MHz			Q62106-A2210-J

Phasenmod/Suchosz. S45035-D5282-A701
PHASE MOD/SEARCH FREQ. OSC.

		Schichtwiderstand LAYER TYPE RESISTOR			
R1	1	4,7kOhm	5%	0,15W	B51262-A2472-J
R2,43	2	30kOhm	5%	0,15W	B51262-A2303-J
R3,8,11, 6,14,20, 41,54,53	9	82 Ohm	5%	0,15W	B51262-A2820-J
R5,22,37	3	1kOhm	5%	0,15W	B51262-A2102-J
R7	1	180 Ohm	5%	0,15W	B51262-A2181-J
R9	1	27 Ohm	5%	0,15W	B51262-A2270-J
R10,33,39	3	1,5kOhm	5%	0,15W	B51262-A2152-J
R15	1	18kOhm	5%	0,15W	B51262-A2183-J
R16,32	2	3,9kOhm	5%	0,15W	B51262-A2392-J
R17	1	1,2kOhm	5%	0,15W	B51262-A2122-J
R18	1	240 Ohm	5%	0,15W	B51262-A2241-J
R19	1	51 Ohm	5%	0,15W	B51262-A2510-J
R23,24,24	3	5,6kOhm	5%	0,15W	B51262-A2562-J
R26	1	100 Ohm	5%	0,15W	B51262-A2101-J
R29	1	11kOhm	5%	0,15W	B51262-A2113-J
R30	1	2,7kOhm	5%	0,15W	B51262-A2272-J
R36,40	2	3kOhm	5%	0,15W	B51262-A2302-J
R38	1	8,2kOhm	5%	0,15W	B51262-A2822-J
R44	1	9,1kOhm	5%	0,15W	B51262-A2912-J
R46	1	620 Ohm	5%	0,15W	B51262-A2621-J
R47,52	2	680 Ohm	5%	0,15W	B51262-A2681-J
R50	1	820 Ohm	5%	0,15W	B51262-A2821-J
R51	1	56kOhm	5%	0,15W	B51262-A2563-J

		Übertrager TRANSFORMER			
Ü1	1				V44231-F3132
Ü2	1				V44231-F3133
L1,2	2	Spule COIL			V45231-F3019
		Drossel CHOKE			
L3	1	40/uH	0,2A		B82501-A-A7
		Tantal-Elko TANTAL ELECTROLYTIC CAP			
C1	1	10/uF	20%	20V	B45170-J3106-M
C12,15,23	3	4,7/uF	20%	20V	B45170-A3475-M
		MKM-Kondensator MKM CAPACITOR			
C2,17	2	0,022/uF	20%	160V	B32435-A2223-M
C3,5	2	0,1/uF	20%	160V	B32435-A2104-M
C4,8	2	0,01/uF	20%	160V	B32435-A2103-M
C16	1	0,068/uF	20%	160V	B32435-A2683-M
		MKL-Kondensator MKL CAPACITOR			
C18,22	2	0,47/uF	20%	63V	B32110-E9474-M
C19	1	0,33/uF	20%	63V	B32110-E9334-M
		Keramik-Kondensator CERAMIC CAPACITOR			
C6,7	2	82pF	10%	500V	B37615-B5820-K1
		Styroflex-Kondensator STYROFLEX CAPACITOR			
C9,11	2	500pF	2%	160V	B31861-A1501-G
C10	1	1000pF	2%	160V	B31861-A1102-G
		Diode DIODE			
Gr1..6	6	BAW 75			Q62702-A396
		Transistor TRANSISTOR			
Ts1..6	6	BCY 58/VIII			Q60203-Y58-H
Ts7	1	BCY 58/X			Q60203-Y58-K
Ts8	1	BCY 78/VII			Q60203-Y78-G

Meßfeld S45035-D5283-B301
INPUT SUBASSEMBLY

	1	Meßfeldplatte INPUT SUBASSEMBLY BOARD	S45035-D5284-B301
L1	1	Spule COIL	V44235-K3039
Bu2	1	Buchseneinheit JACK UNIT	C42334-A176-A10

Meßfeldplatte S45035-D5284-A301
INPUT SUBASSEMBLY BOARD

	1	Z-Platte Z-BOARD			S45035-D5285-B701
	1	Schirmplatte SHIELDING BOARD			S45035-D5286-A701
		Schichtwiderstand LAYER TYPE REISTOR			
R1	1	75,6 Ohm	0,2%		W40207-B6750-C603
R2	1	620 Ohm	5%	0,2W	B51371-A2621-J
R8	1	125 Ohm	0,2%		W40207-B6121-C503
R9	1	1MOhm	5%	0,25W	B51263-A4105-J
R11	1	300 Ohm	2%	0,2W	B31571-A2301-G
R12	1	12kOhm	2%	0,2W	B51371-A2123-G
R15,17	2	100 Ohm	2%	0,2W	B51371-A2101-G
R16	1	2,7kOhm	2%	0,2W	B51371-A2272-G
R19	1	51 Ohm	2%	0,2W	B51371-A2510-G
R20	1	100 Ohm	5%	0,2W	B51371-A2101-J
R22	1	9kOhm	0,05%		C44408-Z22-C3
R23	1	9,9kOhm	0,05%		C44408-Z22-C4

R24	1	101 Ohm	0,05%			C44408-Z22-C1
R25,26	2	33 Ohm	5%	0,2W		B51371-A2330-J
R27	1	100 Ohm	5%	0,2W		B51371-A2101-J
R29	1	1124 Ohm	0,05%			C44408-Z22-C2
R30	1	75 Ohm	2%	0,25W		B54412-A2750-G
R31,32	2	20kOhm	2%	0,2W		B51371-A2203-G
R33	1	27kOhm	5%	0,2W		B51371-A2273-J
R36	1	270 Ohm	5%	0,2W		B51371-A2271-J
R38,68,71, 73,85,92, 94,100, 101,102	10	47 Ohm	5%	0,2W		B51371-A2470-J
R39	1	3kOhm	5%	0,2W		B51371-A2302-J
R40	1	11kOhm	5%	0,2W		B51371-A2113-J
R43	1	4,7kOhm	5%	0,2W		B51371-A2472-J
R44,59	2	10 Ohm	5%	0,2W		B51371-A2100-J
R45	1	51 Ohm	5%	0,2W		B51371-A2510-J
R46	1	820 Ohm	1%	0,2W		B51371-A2821-F
R47	1	370,5 Ohm	0,2%			W40207-B6371-C53
R50	1	6,8kOhm	2%	0,6W		B54322-A4682-G1
R52	1	102,3 Ohm	0,2%			W40207-B6101-C233
R53	1	270 Ohm	5%	0,2W		B51371-A2271-J
R54	1	560 Ohm	0,2%			W40207-B6561-C3
R57	1	9,1kOhm	5%	0,2W		B51371-A2912-J
R58	1	2,7kOhm	5%	0,2W		B51371-A2272-J
R60	1	1kOhm	2%	0,6W		B54322-A4102-G1
R62	1	150 Ohm	5%	0,2W		B51371-A2151-J
R64	1	31,1 Ohm	0,2W			W40207-B6310-C103
R65	1	270 Ohm	1%	0,2W		B51371-A2271-F
R66	1	56 Ohm	1%	0,2W		B51371-A2560-F
R67,79	2	100 Ohm	5%	0,2W		B51371-A2101-J
R72	1	5,6kOhm	5%	0,2W		B51371-A2562-J
R74	1	1,8kOhm	5%	0,2W		B51371-A2182-J
R75	1	82 Ohm	5%	0,2W		B51371-A2820-J
R78	1	39 Ohm	5%	0,2W		B51371-A2390-J
R80	1	75 Ohm	1%	0,2W		B51371-A2750-F
R81	1	5,6kOhm	1%	0,2W		B51371-A2562-F
R86	1	15 Ohm	5%	0,2W		B51371-A2150-J
R93,96	2	22 Ohm	5%	0,2W		B51371-A2220-J
		Drehwiderstand VAR RESISTOR				
R18	1	50 Ohm	20%	lin		C44408-Z4-C3
R37	1	50kOhm	10%	lin		C44408-Z4-C13
R51	1	20kOhm	10%	lin		C44408-Z4-C11
R61	1	2kOhm	10%	lin		C44408-Z4-C8
Ü2	1	Übertrager TRANSFORMER				V44231-B3092-A
		Spule COIL				
L2	1					V44235-K3038
L3	1					V44235-K3059-A
L4,5	2					V44235-K3039
L6	1					V44235-K3040
L7	1					V44235-K3041
L8	1					V44235-K3042
L9	1					V44237-K3016-A
		Keramik-Kondensator CERAMIC CAPACITOR				
C1	1	47pF	5%	NPO		B38222-A5470-J
C2	1	27pF	2%	NPO		B38222-A5270-G
C3	1	4,7pF	0,5pF	NPO		B38222-A5040-D700
C5	1	18pF	5%	NPO		B38222-A5180-D
C8	1	7pF	0,25pF	NPO		B38222-A5070-D
C11	1	4700pF	20%	500V		B37632-B5472-R1
C17,18	2	75pF	5%	NPO		B38222-A5750-J
C24	1	0,8pF	0,25pF	NPO		B38262-A5000-C800
C29,33,40	3	1500pF	20%	500V		B37638-B5152-R
C30,44	2	12pF	5%	NPO		B38212-A5120-J
C38	1	33pF	5%	NPO		B38222-A5330-J
C50,51,57, 59,61,64, 65,66	8	1500pF	20%	500V		B37638-B5152-R
C58	1	10000pF	20%			B37658-A6103-S3
C19	1	6800pF	20%	63V		B37658-A6682-S3
C6	1	3,3pF	0,25pF	500V		B38222-A5030-C301
		MKM-Kondensator MKM CAPACITOR				
C22	1	0,1 µF	20%	160V		B32435-A2104-M
C23	1	0,068 µF	20%	160V		B32435-A2683-M
C31	1	0,033 µF	20%	160V		B32435-A2333-M
		Tantal-Elko TANTAL ELECTROLYTIC CAP				
C25,39	2	2,2 µF	20%	20V		B45170-A3225-M
C26,36,43	3	10 µF	20%	20V		B45170-A3106-M
C32	1	47 µF	20%	6V		B45170-A476-M
C37,46	2	33 µF	20%	10V		B45170-A1336-M
C45	1	22 µF	20%	15V		B45170-A2226-M

		Lufttrimmer AIR DIELECTRIC TRIMMER				
C4	1	1,9...11pF				C40208-Z131-A12
C9,10,12, 15,16	5	1,7...5pF				C40208-Z131-A10
		Diode DIODE				
Gr1	1	ITT 600				Q62702-A281
Gr2,3,7, 8,9,11, 12,13	8	BAW 75				Q62702-A396
		Transistor TRANSISTOR				
Ts1,2	2	2 N 918				V42294-H56
Ts3	1	2 N 918				Q62702-F35
Ts4,5	1	BFY 90				Q60206-Y90
A,B,C,G, H,J,K,L, M,N,P,Q,R	13	Relais RELAY				C44303-Z3-C26

Z-Platte S45035-D5285-B701
Z-BOARD

		Schichtwiderstand LAYER-TYPE RESISTOR				
R3	1	125 Ohm	0,2%			W40207-B6121-C503
R4	1	135 Ohm	0,2%			W40207-B6131-C503
R5	1	150 Ohm	0,2%			W40207-B6151-C3
R87,88,89	3	47 Ohm	5%	0,2W		B51371-A2470-J
Ü1	1	Übertrager TRANSFORMER				C44303-Z3-C26
		Keramik-Kondensator CERAMIC CAPACITOR				
C52,53,54	3	1500pF	20%	500V		B37638-B5152-R
		Diode DIODE				
Gr4,5,6	3	BAW 75				Q62702-A396
D,E,F	3	Relais RELAY				C44303-Z3-C26

Schirmplatte S45035-D5286-A701
SHIELDING BOARD

		Schichtwiderstand LAYER-TYPE RESISTOR				
R95	1	15 Ohm	5%	0,2W		B51371-A2150-J
		Keramik-Kondensator CERAMIC CAPACITOR				
C60	1	1500pF	20%	500V		B37638-B5152-R
		Diode DIODE				
Gr10	1	BAW 75				Q62702-A396

10x1-dB-Teiler S45035-D5287-A101
DIVIDER

	1	Teilerplatte DIVIDER BOARD	S45035-D5287-S1
S3	1	Drehschalter ROTARY SWITCH	V42265-A123-B111

Teilerplatte S45035-D5287-S1
DIVIDER-BOARD

		Schichtwiderstand LAYER-TYPE RESISTOR				
R1,2,3, 5,8	5	20kOhm	5%	0,15W		B51262-A2203-J
R4,9	2	39kOhm	5%	0,15W		B51262-A2393-J
R10,11	2	62kOhm	5%	0,15W		B51262-A2623-J
R12	1	1kOhm	5%	0,15W		B51262-A2102-J
R15	1	2kOhm	5%	0,15W		B51262-A2202-J
R16	1	300 Ohm	5%	0,15W		B51262-A2301-J
Ü1	1	Übertrager TRANSFORMER				V45231-B3038

MKM-Kondensator
MKM-CAPACITOR

C1	1	0,22/uF	20%	160V	B32435-A2224-M
C5,6,7	3	0,1/uF	20%	160V	B32435-A2104-M

Tantal-Elko
TANTAL ELECTROLYTIC CAP

C2	1	2,2/uF	20%	20V	B45170-J3225-M

Keramik-Kondensator
CERAMIC CAPACITOR

C3,4	2	1500pF	20%	500V	B37638-B5152-R

Transistor
TRANSISTOR

Ts1,2,3	3	BCY 58/IX	Q60203-Y58-J

Modulator 1 S45035-D5288-B701
MODULATOR 1

Schichtwiderstand
LAYER-TYPE RESISTOR

R1	1	150 Ohm	1%	0,25W	B54412-A9151-F
R2	1	95 Ohm	1%	0,25W	B54412-A9950-F
R3	1	8,2 Ohm	1%	0,25W	B54412-A9080-F200
R4,8	2	6,8 Ohm	1%	0,25W	B54412-A9060-F800
R5	1	4,7 Ohm	1%	0,25W	B54412-A9040-F700
R9	1	210 Ohm	1%	0,25W	B54412-A9211-F
R10	1	6,8kOhm	5%	0,15W	B51262-A2682-J
R11	1	8,2kOhm	5%	0,15W	B51262-A2822-J
R12,15,22 38,40,47, 76	7	56 Ohm	5%	0,15W	B51262-A2560-J
R 30,31 71	3	470 Ohm	5%	0,15W	B51262-A2471-J
R17,55	2	82 Ohm	5%	0,15W	B51262-A2820-J
R18,56	2	10 kOhm	5%	0,15W	B51262-A2103-J
R19	1	33 Ohm	5%	0,15W	B51262-A2330-J
R23,33	2	1,5kOhm	5%	0,15W	B51262-A2152-J
R24,25,72, 78	4	680 Ohm	5%	0,15W	B51262-A2681-J
R29	1	220 Ohm	5%	0,15W	B51262-A2221-J
R32,79	2	75 Ohm	5%	0,33W	B54413-A2750-J
R36	1	15kOhm	5%	0,15W	B51262-A2153-J
R37	1	9,1kOhm	5%	0,15W	B51262-A2912-J
R39	1	560 Ohm	5%	0,15W	B51262-A2561-J
R43,16	2	270 Ohm	5%	0,15W	B51262-A2271-J
R44	1	820 Ohm	5%	0,15W	B51262-A2821-J
R46	1	1,2kOhm	5%	0,15W	B51262-A2122-J
R50	1	2,7kOhm	5%	0,15W	B51262-A2272-J
R51	1	150 Ohm	5%	0,15W	B51262-A2151-J
R57	1	5,6kOhm	5%	0,15W	B51262-A2562-J
R58	1	100 Ohm	5%	0,15W	B51262-A2101-J
R59,70	2	300 Ohm	5%	0,15W	B51262-A2301-J
R62	1	30 Ohm	5%	0,15W	B51262-A2300-J
R63	1	390 Ohm	5%	0,15W	B51262-A2391-J
R64	1	4,3kOhm	5%	0,15W	B51262-A2432-J
R66	1	3,3kOhm	5%	0,15W	B51262-A2332-J
R69,73	2	200 Ohm	5%	0,15W	B51262-A2201-J
R77	1	10 Ohm	5%	0,15W	B51262-A2100-J

Drehwiderstand
VAR RESISTOR

R26	1	100 Ohm	20%	lin	W40961-A8101-M1
R45	1	47 Ohm	20%	lin	W40961-A8470-M1
R65	1	1kOhm	20%	lin	W40961-A8102-M1

Übertrager
TRANSFORMER

Ü1	1	V45231-H3001-A2
Ü2	1	V45231-H3001-A1

Spule
CHOKE

L1	1	V45231-F3109
L2,4	2	V45231-F3110
L3	1	V45231-F3111

UKW-Drossel
VHF CHOKE

L5	1	10/uH	1A	B82501-A-C15

Keramik-Kondensator
CERAMIC CAPACITOR

C1	1	6800pF	20%	500V	B37643-B5682-R3
C3	1	3,9pF 0,25pF		NPO	B38212-A5030-C903
C8	1	23,8pF	2%	N075	B38221-J5230-G803
C11	1	32,6pF	2%	N075	B38221-J5320-G603
C16	1	15,7pF	2%	N075	B38221-J5150-G703
C19	1	4,7pF 0,5pF		P100	B38210-A5040-D703
C22	1	5,6pF	1pF	N750	B38216-J5050-F603
C26	1	390pF	10%	500V	B37618-B5391-K3
C29...33, 36..38, 40,42, 43,44	12	1500pF	20%	500V	B37638-B5152-R
C39	1	1,5pF 0,25pF		P100	B38210-A5010-C503

Styroflex-Kondensator
STYROFLEX-CAPACITOR

C2	1	33,2pF	1pF	160V	B31861-A1330-F200
C4,5	2	27,3pF	1pF	160V	B31861-A1270-F300
C9,10	2	21pF	1pF	160V	B31861-A1210-F
C12,15	2	22,7pF	1pF	160V	B31861-A1220-F700
C17	1	8,2pF	1pF	160V	B31861-A1080-F200

MKM-Kondensator
MKM CAPACITOR

C18	1	0,1/uF	20%	160V	B32435-A2104-M

MKL-Kondensator
MKL CAPACITOR

C25	1	6,8/uF	20%	25V	B32110-C3685-M

Tantal-Elko
TANTAL ELECTROLYTIC CAP

C23	1	47/uF	20%	20V	B45170-J3476-M
C24	1	1/uF	20%	35V	B45170-J4105-M

Transistor
TRANSISTOR

Ts1..8	8	2 N 918	Q62702-F35

Diodenquartett
DIODE QUARTET

Gr1...4	1	HP 5082-2805	Q62702-A363-F39

Modulator 2 S45035-D5289-A701
MODULATOR 2

Schichtwiderstand
LAYER-TYPE RESISTOR

R1	1	205 Ohm	1%	0,1W	B51263-A9201-F500
R2	1	5,6kOhm	1%	0,1W	B51263-A9562-F
R3	1	3,6kOhm	1%	0,1W	B51263-A9362-F
R4	1	10kOhm	2%	0,15W	B51262-A2103-G
R5,11	2	51 Ohm	5%	0,15W	B51263-A2510-J
R8,15	2	10 Ohm	5%	0,15W	B51263-A2100-J
R9	1	4,7kOhm	5%	0,15W	B51262-A2472-J
R10,12,37	3	200 Ohm	5%	0,15W	B51262-A2201-J
R16	1	1,5kOhm	5%	0,15W	B51262-A2152-J
R17	1	82 Ohm	2%	0,15W	B51262-A2820-G
R18,32	2	8,2kOhm	5%	0,15W	B51262-A2822-J
R19	1	3kOhm	5%	0,15W	B51262-A2302-J
R22,25,39	3	100 Ohm	5%	0,15W	B51262-A2101-J
R23,38,29, 30,31	5	470 Ohm	1%	0,25W	B51263-A2471-F
R24	1	56 Ohm	2%	0,15W	B51262-A2560-G
R35	1	68 Ohm	2%	0,15W	B51262-A2680-G
R36	1	20kOhm	5%	0,15W	B51262-A2203-J
R38	1	10kOhm	5%	0,15W	B51262-A2103-J
R40	1	2kOhm	5%	0,15W	B51262-A2202-J

Übertrager
TRANSFORMER

Ü1	1	V45231-C3049
Ü2	1	V45231-C3050
Ü3	1	V45231-C3051

Spule
CHOKE

L1,2	2	V45231-C3052

HF-Drossel
RF CHOKE

L3	1	3/uH	1,5A	B82501-A-A3

UKW-Drossel
VHF-CHOKE

L4	1	10/uH	1A	B82501-A-C15
L5	1	23/uH	0,5A	B82501-A-C16

Keramik-Kondensator
CERAMIC CAPACITOR

C1	1	93,5pF	1%	N075	B38221-J5930-F503
C3	1	19,2pF	2%	N075	B38221-J5190-G203
C4	1	21,4pF	2%	N075	B38221-J5210-G403
C8	1	18,3pF	2%	N075	B38221-J5180-G503

C9	1	20,5pF	2%	N075	B38221-J5200-G503
C11,15	2	1,5pF	0,5pF	N033	B38210-J5010-D503
C10,16,17, 19,22,23, 24,32	8	1500pF	20%	500V	B37638-B5152-R3
C18	1	110pF	1%	N075	B38221-J5111- 5
C29	1	70pF	1%	N075	B38221-J5700-F3
C31	1	5,6pF	1pF	N075	B38221-J5050-F603

Duko
LEAD THROUGH CAPACITOR

C25	1	2500pF	20%	500V	B37046-A5252-Z2

MKM-Kondensator
MKM-CAPACITOR

C26,33	2	0,1/uF	10%	160V	B32435-A2104-K
C30	1	0,01/uF	1pF	N075	B32435-A2103-K

Luft-Trimmer
AIR DIELECTRIC TRIMMER

C2,5,12	2	1,2...5pF			C40208-Z131-A10

Transistor
TRANSISTOR

Ts1,2,4	3	2 N 918			Q62702-P35
Ts3	1	BCY 58/VIII			Q60203-Y58-H

Diodenquartett
DIODE QUARTET

Gr1...4	4	HP 5280-2805			Q62702-A363-P39

Modulator 3 S45035-D5290-A701
MODULATOR 3

Schichtwiderstand
LAYER-TYPE RESISTOR

R1	1	390 Ohm	1%	0,25W	B51263-A2391-F
R2,3	2	7,5kOhm	5%	0,15W	B51262-A2752-J
R4,22,25, 30,36	5	100 Ohm	5%	0,15W	B51262-A2101-J
R5	1	910 Ohm	5%	0,15W	B51262-A2911-J
R6,10,11, 12,15	5	1kOhm	2%	0,15W	B51262-A2102-G
R8	1	68 Ohm	5%	0,15W	B51262-A2680-J
R9,37	2	200 Ohm	5%	0,15W	B51262-A2201-J
R17	1	15kOhm	5%	0,15W	B51262-A2153-J
R19	1	1,5kOhm	5%	0,15W	B51262-A2152-J
R23	1	200 Ohm	2%	0,15W	B51262-A2201-G
R24	1	30 Ohm	2%	0,15W	B51262-A2300-G
R26	1	10kOhm	5%	0,15W	B51262-A2103-J
R29	1	8,2kOhm	5%	0,15W	B51262-A2822-J
R31	1	3,3kOhm	5%	0,15W	B51262-A2332-J
R32	1	2kOhm	1%	0,25W	B51263-A2202-F
R33	1	910 Ohm	1%	0,25W	B51263-A2911-F
R38	1	2kOhm	5%	0,15W	B51262-A2202-J
R18	1	1kOhm	5%	0,15W	B51262-A2102-J

Drehwiderstand
VAR RESISTOR

R13,14	2	100 Ohm	20%	lin	W40961-B8101-M1

Übertrager
TRANSFORMER

Ü1	1				V45231-B3017
Ü2	1				V45231-B3018

Spule
COIL

L1,2	2				V45231-B3019
L3	1				V45231-B3020

UKW-Drossel
VHF CHOKE

L4	1	40/uH	0,3A		B82501-A-A7

Styroflex-Kondensator
STYROFLEX CAPACITOR

C1	1	884pF	1%	160V	B31861-A1881-F400
C3	1	116pF	1%	160V	B31861-A1111-F600
C4	1	846pF	1%	160V	B31861-A1841-F600
C8	1	17pF	1pF	160V	B31861-A1170-F
C23	1	220pF	1%	160V	B31861-A1221-F
C24	1	3370pF	1%	160V	B31863-B1332-F700

Keramik-Kondensator
CERAMIC CAPACITOR

C2,5	2	180pF	1%	N033	B38240-S5181-F1
C9	1	132pF	1%	N033	B38240-S5131-F1
C13	1	33pF	5%	NPO	B38222-A5330-J
C16	1	15pF	5%	N033	B38220-J5150-J3
C26	1	20pF	10%	N075	B38221-J5200-K3

MKM-Kondensator
MKM-CAPACITOR

C11,15,22, 25	4	0,1/uF	10%	160V	B32435-A2104-K
C10,12,19	3	0,01/uF	10%	160V	B32435-A2103-K
C30	1	0,22/uF	10%	160V	B32435-A2224-K

Tantal-Elko
TANTAL-ELECTROLYTIC CAP

C29	1	15/uF	20%	20V	B45170-J3156-M

Lufttrimmer
AIR DIELECTRIC TRIMMER

C17	1	1,9...11pF			C40208-Z131-A12

Diodenquartett
DIODE QUARTET

Gr1...4	4	HP 5280-2805			Q62702-A363-P39

Diode
DIODE

Gr5	1	BAW 75			Q62702-A396

Zenerdiode
ZENER DIODE

Gr8	1	BZX 55 C8 V2			V42292-H26-D
Gr9	1	BZX 55 C6 V8			Q62702-Z572

Transistor
TRANSISTOR

Ts1..4	4	BCY 58/VIII			Q60203-Y58-H

Quarz
CRYSTAL

Kr	1	2,3 MHz			Q82115-A2300-H

80-Hz-Quarz-BP S45035-D5291-B701
CRYSTAL BAND-PASS FILTER

Schichtwiderstand
LAYER-TYPE REISTOR

R1,18	2	200 Ohm	5%	0,15W	B51370-A2201-J
R2	1	30kOhm	5%	0,15W	B51370-A2303-J
R3	1	51kOhm	5%	0,15W	B51370-A2513-J
R4,16	2	100 Ohm	5%	0,15W	B51370-A2101-J
R5	1	1,2kOhm	5%	0,15W	B51370-A2122-J
R9	1	590 Ohm	1%	0,2W	B51371-A2591-F
R10	1	390 Ohm	5%	0,15W	B51370-A2391-J
R12	1	8,2kOhm	5%	0,15W	B51370-A2822-J
R14	1	2,2kOhm	5%	0,15W	B51370-A2222-J
R15	1	9,1kOhm	1%	0,2W	B51371-A2912-F
R17	1	1,8kOhm	5%	0,15W	B51370-A2182-J

Thernewid
THERNEWID THERMISTOR

R8	1	100kOhm	10%		Q63011-K104-K

Drehwiderstand
VAR RESISTOR

R11	1	2,2kOhm	20%	lin	Q40961-A8222-M1

Übertrager
TRANSFORMER

Ü1	1				V45231-C3181
Ü2	1				V45231-C3182
Ü3	1				V45231-C3183-

MKM-Kondensator
MKM-CAPACITOR

C1	1	0,01/uF	20%	160V	B32435-A2103-M
C3,17,20	3	0,1/uF	20%	160V	B32435-A2104-M

Tantal-Elko
TANTAL-ELECTROLYTIC CAP

C2,19	2	15/uF	20%	20V	B45170-A3156-M

Styroflex-Kondensator
STYROFLEX CAPACITOR

C4,16	2	567pF	1%	160V	B31861-A1561-F700
C8,9,12	3	58pF	1%	160V	B31861-A1580-F
C11	1	130pF	1%	160V	B31861-A1131-F

Keramik-Kondensator
CERAMIC-CAPACITOR

C18	1	20pF	5%	N150	B38212-J5200-J3

Lufttrimmer
AIR-DIELECTRIC TRIMMER

C5,10,15	3	2...31pF			V42246-Z19-A14

S	1	Relais			C44303-Z3-C26

RELAY

		Quarz CRYSTAL	
	3	99,94kHz	Q83402-A9994-F
		Diode DIODE	
Gr1	1	BAW 75	Q62702-A396
		Transistor TRANSISTOR	
Ts1,2	2	BCY 58/VIII	Q60203-Y58-H

1,74-kHz-Filter S45035-D5150-B711

BAND-PASS FILTER

		Schichtwiderstand LAYER-TYPE RESISTOR			
R1	1	1kOhm	1%	0,25W	B51371-A2102-F
R2	1	12kOhm	2%	0,15W	B51370-A2123-G
R3	1	8,2kOhm	2%	0,15W	B51370-A2822-G
R4	1	100 Ohm	5%	0,15W	B51370-A2101-J
R5	1	600 Ohm	2%	0,15W	B51370-A2601-G
R8	1	240 Ohm	5%	0,15W	B51370-A2241-J
R10,12,15	3	330 Ohm	5%	0,15W	B51370-A2331-J
R11,25	2	6,8kOhm	5%	0,15W	B51370-A2682-J
R16	1	2,7kOhm	5%	0,15W	B51370-A2272-J
R17	1	2,2kOhm	5%	0,15W	B51370-A2222-J
R18,26	2	180 Ohm	5%	0,15W	B51370-A2181-J
R22,23	2	20kOhm	2%	0,15W	B51370-A2203-G
R24	1	22 Ohm	5%	0,15W	B51370-A2220-J
R28	1	68 Ohm	5%	0,15W	B51370-A2680-J
R19	1	56 Ohm	5%	0,15W	B51370-A2560-J
		Drehwiderstand VAR RESISTOR			
R9	1	100 Ohm	20%	lin	W40961-B8101-M1
		Spule COIL			
L1	1				V45231-C3229
L2	1				V45231-C3230
L3	1				V45231-C3231
		Mechan. Filter BP BAND-PASS FILTER			
	1	100 kHz			V45312-Z3001-A2
		Styroflex-Kondensator STYROFLEX-CAPACITOR			
C1	1	4759pF	1%	160V	B31863-B1472-F590
C2	1	332pF	1%	160V	B31861-A1331-F200
C3	1	4739pF	1%	160V	B31863-B1472-F390
C4	1	4794pF	1%	160V	B31863-B1472-F940
C5	1	276pF	1%	160V	B31861-A1271-F600
C8	1	4807pF	1%	160V	B31863-B1482-P70
		MKM-Kondensator MKM-CAPACITOR			
C9,16	2	0,01/uF	20%	160V	B32435-A2103-M
C11,14,15,18	4	0,22/uF	20%	160V	B32435-A2224-M
C12,13,19,20	4	0,1/uF	20%	160V	B32435-A2104-M
		Tantal-Elko TANTAL-ELECTROLYTIC CAP			
C10,17	2	15/uF	20%	20V	B45170-A3156-M
	2	Relais RELAY			C44303-Z3-C26
		Diode DIODE			
Gr1,2	2	BAW 75			Q62702-A396
		Transistor TRANSISTOR			
Ts1..4	4	BCY 58/IX			Q60203-Y58-J

100-kHz-Vorverstärker S45035-D5293-B301

PREAMPLIFIER

		Schichtwiderstand LAYER-TYPE RESISTOR			
R1	1	6,2kOhm	5%	0,6W	B51372-A2622-J
R2,5,10,15,18,53,58,61,66,69,74,79	12	10kOhm	5%	0,6W	B51372-A2103-J
R3,8,11,16,19,54,59,62,67,72,75,80	12	1,2kOhm	5%	0,6W	B51372-A2122-J
R4,9,12,17,22,55,60,65,68,73,76,81,29,30	14	33kOhm	5%	0,6W	B51372-A2333-J
R23,24,44	3	22kOhm	5%	0,6W	B51372-A2223-J
R25,33,82,89	4	220 Ohm	5%	0,6W	B51372-A2221-J
R26	1	1kOhm	5%	0,6W	B51372-A2102-J
R31	1	110kOhm	2%	0,6W	B51372-A2114-G
R32	1	27kOhm	2%	0,6W	B51372-A2273-G
R34	1	100 Ohm	5%	0,6W	B51372-A2101-J
R36	1	10kOhm	2%	0,6W	B51372-A2103-G
R37	1	1,1kOhm	2%	0,6W	B51372-A2112-G
R38	1	2,2kOhm	5%	0,25W	B51263-A2222-J
R43,50,102	3	82 Ohm	5%	0,6W	B51372-A2820-J
R45	1	1,5kOhm	5%	0,25W	B51263-A2152-J
R51	1	3kOhm	5%	0,6W	B51372-A2302-J
R52	1	270 Ohm	5%	0,6W	B51372-A2271-J
R83	1	2,2kOhm	1%	0,25W	B51263-A2222-F
R86	1	330 Ohm	1%	0,2W	B51371-A2331-F
R87	1	2,7kOhm	1%	0,2W	B51371-A2272-F
R90	1	39kOhm	5%	0,6W	B51372-A2393-J
R93	1	300 Ohm	5%	0,6W	B51372-A2301-J
R100,101	2	68kOhm	5%	0,6W	B51372-A2683-J
R104	1	5,6kOhm	5%	0,6W	B51372-A2562-J
		Drehwiderstand VAR RESISTOR			
R27	1	470 Ohm	20%	lin	W40961-B8471-M1
		Übertrager TRANSFORMER			
Ü1	1				V44231-F3145
Ü2,3,4	3				V44231-F3121
		Tantal-Elko TANTAL-ELECTROLYTIC CAP			
C1,24	2	4,7/uF	20%	10V	B45170-A1475-M
C2,39,43	3	2,2/uF	20%	20V	B45170-J3225-M
C14,23	2	15/uF	20%	35V	B45170-J4156-M
C25,33	2	15/uF	20%	20V	B45170-J3156-M
		Keramik-Kondensator CERAMIC CAPACITOR			
C3,4,5,8,9,26,30,31,32,36,37	12	8000pF	20%	500V	B37636-B5802-M1
C15	1	1500pF	20%	500V	B37638-B5152-R1
		MKM-Kondensator MKM-CAPACITOR			
C6,10,12,	6	0,1/uF	20%	160V	B32435-A2104-M
		Diode DIODE			
Gr1	1	BAW 75			Q62702-A396
		Transistor TRANSISTOR			
Ts1...5,8...11,15...19,22...25	18	BCY 58/VIII			Q60203-Y58-J
Ts6	1	BCY 58/X			Q60203-Y58-K
Ts12	1	BCY 78/VIII			Q60203-Y78-H
	1	Relais RELAY			C44303-Z3-C26

100-kHz-Endverstärker S45035-D5294-A701

FINAL AMPLIFIER

		Schichtwiderstand LAYER-TYPE REISTOR			
R1	1	43kOhm	5%	0,15W	B51262-A2433-J
R2	1	24kOhm	5%	0,15W	B51262-A2243-J
R3	1	4,3kOhm	5%	0,15W	B51262-A2432-J
R4,15,23,29	4	330 Ohm	5%	0,15W	B51262-A2331-J
R5	1	62kOhm	5%	0,15W	B51262-A2623-J
R8	1	1kOhm	5%	0,15W	B51262-A2102-J
R9,16	2	12kOhm	5%	0,15W	B51262-A2123-J
R11	1	220kOhm	5%	0,15W	B51262-A2224-J
R12	1	47kOhm	5%	0,15W	B51262-A2473-J
R17	1	5,6kOhm	5%	0,15W	B51262-A2562-J
R18	1	180 Ohm	2%	0,15W	B51262-A2181-G

R19	1	56kOhm	5%	0,15W	B51262-A2563-J
R22	1	10kOhm	5%	0,15W	B51262-A2103-J
R24	1	2,7kOhm	5%	0,15W	B51262-A2272-J
R30	1	82 Ohm	5%	0,15W	B51262-A2820-J
R31	1	8,2kOhm	1%	0,25W	B51372-A2822-F
R33	1	1,2kOhm	5%	0,15W	B51262-A2122-J
R36,43,44, 25	4	100 Ohm	5%	0,15W	B51262-A2101-J
R37	1	200 Ohm	5%	0,15W	B51262-A2201-J
R38,40	2	8,2kOhm	5%	0,15W	B51262-A2822-J
R39	1	13kOhm	5%	0,15W	B51262-A2133-J
R45,49	2	56 Ohm	5%	0,15W	B51262-A2560-J
R46,47	2	150 Ohm	5%	0,15W	B51262-A2151-J
R20	1	47 Ohm	5%	0,15W	B51262-A2470-J
R26	1	470 Ohm	5%	0,15W	B51262-A2471-J
		Thernewid THERNEWID THERMISTOR			
R10	1	20kOhm	10%	3,8	Q63011-K203-K
		Drehwiderstand VAR RESISTOR			
R32	1	470 Ohm	20%	lin	V44215-Z3008-A6
		Übertrager TRANSFORMER			
Ü1	1				V44231-F3122
Ü2	1				V44231-F3123
		MKM-Kondensator MKM-CAPACITOR			
C1,4	2	0,01 µF	20%	160V	B32435-A2103-M
C2	1	0,1 µF	20%	160V	B32435-A2104-M
		MKL-Kondensator MKL-CAPACITOR			
C5	1	0,33 µF	20%	63V	B32110-E9334-M
C19,23	2	0,1 µF	20%	100V	B32110-D104-M
C22,24	2	1,5 µF	20%	63V	B32110-F9155-M
		Keramik-Kondensator CERAMIC-CAPACITOR			
C8	1	470pF	20%	500V	B37635-B5471-R
C11	1	6,8pF	0,25pF	N150	B38222-J5060-C800
C15	1	4pF	0,25pF	N150	B38212-J5040-C
		Tantal-Elko TANTAL-ELECTROLYTIC CAP			
C9,12,16	3	2,2 µF	20%	10V	B45170-J1225-M
C10	1	15 µF	20%	35V	B45170-J4156-M
C13	1	6,8 µF	20%	25V	B45170-A8685-M
		Styroflex-Kondensator STYROFLEX-CAPACITOR			
C17,18	2	9300pF	5%	160V	B31863-B1932-J
		Zenerdiode ZENER DIODE			
Gr1	1	BZX 55 C6 V8			Q62702-Z572
		Transistor TRANSISTOR			
Ts1..5	5	BCY 58 /VIII			Q62203-Y58-H
Ts6	1	BCY 78/VIII			Q60203-Y78-H

Meßkreisplatte S45035-D5295-B701
MEAS CIRCUIT

		Schichtwiderstand LAYER-TYPE RESISTOR			
R1,2,51	3	1kOhm	5%	0,15W	B51262-A2102-J
R3	1	100kOhm	5%	0,15W	B51262-A2104-J
R4	1	8,2kOhm	5%	0,15W	B51262-A2822-J
R5,26	2	4,7kOhm	5%	0,15W	B51262-A2472-J
R9	1	5,1kOhm	5%	0,15W	B51262-A2512-J
R11	1	4,7kOhm	5%	0,15W	B51262-A2472-J
R15	1	4,7kOhm	5%	0,15W	B51262-A2472-J
R16	1	180kOhm	5%	0,15W	B51262-A2184-J
R17	1	75kOhm	5%	0,15W	B51262-A2753-J
R18	1	620 Ohm	5%	0,6W	B51372-A2621-J
R19	1	160kOhm	5%	0,15W	B51262-A2164-J
R23	1	1,5kOhm	5%	0,15W	B51262-A2152-J
R25,58	2	2kOhm	5%	0,15W	B51262-A2202-J
R27,36,38	3	22kOhm	5%	0,15W	B51262-A2223-J
R29	1	2,4kOhm	5%	0,15W	B51262-A2242-J
R31	1	5,6kOhm	5%	0,15W	B51262-A2562-J
R32	1	510 Ohm	5%	0,15W	B51262-A2511-J
R33	1	470 Ohm	5%	0,15W	B51262-A2471-J
R39	1	750 Ohm	5%	0,15W	B51262-A2751-J
R40,57,60, 61	4	10kOhm	5%	0,15W	B51262-A2103-J
R43	1	200 Ohm	5%	0,6W	B51372-A2201-J
R44	1	62kOhm	5%	0,15W	B51262-A2623-J
R45	1	12kOhm	5%	0,15W	B51262-A2123-J
R46,53	2	100 Ohm	5%	0,15W	B51262-A2101-J
R47	1	3,3kOhm	5%	0,15W	B51262-A2332-J
R52	1	1,5kOhm	5%	0,15W	B51262-A2152-J
R54	1	560 Ohm	5%	0,15W	B51262-A2561-J
R59	1	470 Ohm	5%	0,15W	B51262-A2471-J
R62	1	20kOhm	5%	0,15W	B51262-A2203-J
R50	1	820 Ohm	5%	0,15W	B51262-A2821-J
		Drehwiderstand VAR RESISTOR			
R8,12	2	2,2kOhm	20%	lin	W40961-A8222-M1
R10	1	4,7kOhm	20%	lin	W40961-A8472-M1
R24,37	2	10kOhm	20%	lin	W40961-A8103-M1
R30	1	1kOhm	20%	lin	W40961-A8102-M1
		Thernewid THERNEWID THERMISTOR			
R22	1	5kOhm	10%	3,8	Q63011-K502-K
Ü1	1	Übertrager TRANSFORMER			V45231-F3037
		Spule COIL			
L1	1				V45231-F3036
		MKM-Kondensator MKM-CAPACITOR			
C1,4	2	0,1 µF	20%	160V	B32435-A2104-M
		MKL-Kondensator MKL-CAPACITOR			
C2	1	1 µF	20%	63V	B32110-E9105-M
C10	1	0,68 µF	20%	63V	B32110-E9684-M
C12	1	1,5 µF	20%	63V	B32110-E9155-M
		Keramik-Kondensator CERAMIC-CAPACITOR			
C3	1	4700pF	20%	500V	B37632-B5472-R1
C19	1	1500pF	20%	500V	B37638-B5152-R
		Tantal-Elko TANTAL-ELECTROLYTIC CAP			
C5	1	15 µF	20%	35V	B45170-J4156-M
		Styroflex-Kondensator STYROFLEX-CAPACITOR			
C8,9	2	4700pF	5%	160V	B31863-B1472-J
C11	1	1000pF	5%	160V	B31861-A1102-J
C15	1	2395pF	1%	160V	B31861-A1232-F950
C17	1	132pF	1%	160V	B31861-A1131-F200
		Lufttrimmer AIR-DIELECTRIC TRIMMER			
C16,18	2	1,7...19pF			C40208-Z130-A76
		Diode DIODE			
Gr1,2,3	3	HP 5082-2800			Q62702-A284-F39
Gr4,5,8, 9,10,15, 16,17,18	9	BAW 75			Q62702-A396
Gr11	1	1 N 935			Q62702-Z568
Gr12	1	BZX 55 C10			Q62702-Z682
R19	1	BZX 55 C6 V8			Q62702-Z572
		Transistor TRANSISTOR			
Ts1...6	6	BCY 58/VIII			Q60203-Y58-H
		Int. Schaltkreis INT. CIRCUIT			
JC1	1	CA 3036			Q67000-A73
W,X	2	Relais RELAY			C44303-Z3-C26

AFC- und Overload-Platte S45035-D5296-B701
AFC-/OVERLOAD-BOARD

		Schichtwiderstand LAYER-TYPE RESISTOR			
R1	1	1kOhm	5%	0,15W	B51262-A2102-J
R2	1	2,2kOhm	5%	0,15W	B51262-A2222-J
R4	1	91 Ohm	2%	0,25W	B54412-A2910-G
R5	1	220kOhm	5%	0,15W	B51262-A2224-J
R6,15,19	3	100 Ohm	5%	0,15W	B51262-A2101-J
R8	1	16kOhm	5%	0,15W	B51262-A2163-J
R9	1	120kOhm	5%	0,15W	B51262-A2124-J
R10	1	1MOhm	5%	0,6W	B51372-A2105-J

R11	1	18kOhm	2%	0,15W	B51262-A2183-G
R12	1	12kOhm	2%	0,15W	B51262-A2123-G
R14	1	22kOhm	5%	0,15W	B51262-A2223-J
R16,18	2	1,5kOhm	5%	0,15W	B51262-A2152-J
R17	1	220 Ohm	5%	0,6W	B51372-A2221-J
R30	1	82 Ohm	5%	0,5W	B51371-A2820-J
R31	1	9,1kOhm	5%	0,5W	B51371-A2912-J
R32	1	15kOhm	5%	0,5W	B51371-A2153-J
R33	1	390 Ohm	5%	0,5W	B51371-A2391-J
R34	1	68 Ohm	5%	0,5W	B51371-A2680-J
R37	1	270 Ohm	2%	0,5W	B51371-A2271-G
R38	1	620 Ohm	5%	0,5W	B51371-A2621-J
R39	1	30 Ohm	2%	0,5W	B51371-A2300-G
R40	1	11kOhm	5%	0,5W	B51371-A2113-J
R41	1	15kOhm	5%	0,5W	B51371-A2153-J
R44	1	100 Ohm	5%	0,5W	B51371-A2101-J
R45	1	1,2kOhm	5%	0,5W	B51371-A2122-J
R46	1	22 Ohm	5%	0,5W	B51371-A2220-J
R47	1	91 Ohm	5%	0,5W	B51371-A2910-J
R48	1	150 Ohm	5%	0,5W	B51371-A2151-J
R51	1	330 Ohm	1%	0,5W	B51371-A2331-J
R52	1	510 Ohm	5%	0,5W	B51371-A2511-J
R53	1	27 Ohm	1%	0,5W	B51371-A2270-J
R54,55	2	100kOhm	5%	0,5W	B51371-A2104-J
R58	1	22 Ohm	5%	0,5W	B51371-A2220-J
R59	1	18kOhm	5%	0,5W	B51371-A2183-J
R60	1	2,2kOhm	5%	0,5W	B51371-A2222-J
R62	1	3kOhm	5%	0,5W	B51371-A2302-J
R65,68	2	10kOhm	5%	0,5W	B51371-A2103-J
R66	1	1,8kOhm	5%	0,5W	B51371-A2182-J
R67	1	120 Ohm	5%	0,5W	B51371-A2121-J
R69	1	1,8kOhm	5%	0,5W	B51371-A2182-J
R70	1	120 Ohm	5%	0,5W	B51371-A2121-J

Drehwiderstand
VAR RESISTOR

R61	1	1kOhm	20%	lin	W40961-A8102-M1

Spule
COIL

L1	1				V42235-K433-B10
L2	1				V42235-K437-B10

MKM-Kondensator
MKM-CAPACITOR

C1,2,3,5, 8,11,15, 16,18,19	10	0,1 /uF	20%	160V	B32435-A2104-M
C12	1	0,022 /uF	20%	160V	B32435-A2223-M
C38,40, 44,46	4	0,068 /uF	20%	160V	B32435-B2683-M

MKL-Kondensator
MKL-CAPACITOR

C10	1	0,22 /uF	20%	63V	B32110-F9224-M
C22,32	2	0,47 /uF	20%	63V	B32110-F9474-M
C23	1	3,3 /uF	20%	25V	B32110-D3335-M

Tantal-Elko
TANTAL-ELECTROLYTIC CAP

C4,7	2	3,3 /uF	20%	15V	B45170-J2335-M
C17	1	2,2 /uF	20%	20V	B45170-A3225-M
C30,47	2	6,8 /uF	20%	20V	B45170-A3685-M
C31,37	2	10 /uF	20%	20V	B45170-A3106-M
C33	1	0,47 /uF	20%	20V	B45170-A3474-M
C34,39	2	15 /uF	20%	20V	B45170-A3156-M
C41,45	2	1 /uF	20%	20V	B45170-A3105-M

Keramik-Kondensator
CERAMIC-CAPACITOR

C9	1	4700pF	20%	60V	B37658-A6472-S3
C20	1	3300pF	20%		B37623-B5332-M

Int. Schaltkreis
INT. CIRCUIT

JC1	1	TBA 120			V42297-Z3
JC2,3	2	/uA 741			Q67000-A154-F72

Transistor
TRANSISTOR

Ts1,2,3	3	BCY 58/VIII			Q60203-Y58-H
Ts5,6,7	3	2 N 918			Q62702-F35
Ts8,9	2	BSX 62-6			Q60218-X62-B

Diode
DIODE

Gr1,2,5, 8,11,12, 15,16	8	BAW 75			Q62702-A396
Gr3	1	BZX 55 B6 V8			Q62702-Z913
Gr4	1	BZX 55 B12			Q62702-Z919
Gr20...23	4	HP 5082-2800			Q62702-A284-F39

Relais
RELAY

Y	1	RSD 16V			C44303-Z3-C26

Eichgenerator S45035-D5297-B701
CAL-GENERATOR

Schichtwiderstand
LAYER-TYPE RESISTOR

R1	1	1,8kOhm	5%	0,15W	B51370-A2182-J
R2,38	2	47kOhm	5%	0,15W	B51370-A2473-J
R3	1	51kOhm	5%	0,15W	B51370-A2513-J
R4,12,40, 45,50,74	6	220 Ohm	5%	0,15W	B51370-A2221-J
R5	1	39kOhm	5%	0,15W	B51370-A2393-J
R8	1	10 Ohm	5%	0,15W	B51262-A2100-J
R9	1	2kOhm	5%	0,15W	B51370-A2202-J
R10	1	22kOhm	2%	0,15W	B51370-A2223-G
R11	1	6,8kOhm	2%	0,15W	B51370-A2682-G
R15	1	1,2kOhm	5%	0,15W	B51370-A2122-J
R16,23,24, 26,47,75	6	1kOhm	5%	0,15W	B51370-A2102-J
R17	1	750 Ohm	5%	0,15W	B51370-A2751-J
R18,22	2	18kOhm	5%	0,15W	B51370-A2183-J
R25	1	10kOhm	5%	0,15W	B51370-A2103-J
R27	1	560 Ohm	5%	0,15W	B51370-A2561-J
R29	1	2,7kOhm	5%	0,15W	B51370-A2272-J
R30,58	2	510 Ohm	5%	0,15W	B51370-A2511-J
R31	1	5,1kOhm	5%	0,15W	B51370-A2512-J
R43	1	2,7kOhm	5%	0,15W	B51370-A2272-J
R33	1	3,9kOhm	5%	0,15W	B51370-A2392-J
R36,90	2	47 Ohm	5%	0,15W	B51370-A2470-J
R39	1	12kOhm	2%	0,15W	B51370-A2123-G
R44	1	470 Ohm	2%	0,15W	B51370-A2471-G
R46	1	390 Ohm	5%	0,15W	B51370-A2391-J
R51	1	820 Ohm	2%	0,15W	B51370-A2821-G
R52	1	15 Ohm	5%	0,15W	B51262-A2150-J
R53,43	2	3,9kOhm	2%	0,15W	B51370-A2392-G
R57	1	2kOhm	5%	0,15W	B51370-A2202-J
R59	1	47 Ohm	5%	0,15W	B51370-A2470-J
R60	1	270kOhm	2%	0,3W	B51372-A2274-G
R61	1	2,7kOhm	2%	0,15W	B51370-A2272-G
R64	1	120kOhm	2%	0,15W	B51371-A2124-G
R65	1	270kOhm	5%	0,2W	B51371-A2274-J
R66	1	470 Ohm	5%	0,15W	B51370-A2471-J
R67	1	1,8kOhm	1%	0,15W	W40207-A6182-F3
R69,70	2	180 Ohm	2%	0,1W	B54381-A181-G1
R71,32	2	2,2kOhm	1%	0,15W	W40207-A6222-F3
R72,73	2	27kOhm	5%	0,15W	B51370-A2273-J
R76,77	2	470 Ohm	2%	0,25W	B54412-A2471-G
R78	1	75 Ohm	2%	0,15W	B51370-A2750-G
R79,81, 82,84,85	5	390 Ohm	2%	0,25W	B54412-A2391-G
R80,83,87	3	82 Ohm	2%	0,25W	B54412-A2820-G
R86	1	47 Ohm	2%	0,25W	B54412-A2470-G
R89	1	270 Ohm	2%	0,25W	B54412-A2271-G

Drehwiderstand
VAR RESISTOR

R19	1	4,7kOhm	20%	lin	W40961-B8472-M1
R37	1	47kOhm	20%	lin	W40961-B8473-M1
R68	1	470 Ohm	10%	lin	W40961-B8471-K1
R88	1	47 Ohm	20%	lin	W40961-B8470-M1

Übertrager
TRANSFORMER

Ü1	1				V44231-C3249
Ü2	1				V44231-C3250

Spule
COIL

L1	1				V44231-C3251
L2	1				V44231-C3253

UKW-Drossel
VHF-CHOKE

L3	1	40 /uH	0,2A		B82501-A-C7

MKM-Kondensator
MKM-CAPACITOR

C1,2,3, 10,11,24, 26,29	8	0,1 /uF	20%	160V	B32435-A2104-M
C9	1	0,033 /uF	20%	160V	B32435-A2333-M
C23,25	2	0,01 /uF	20%	160V	B32435-A2103-M

		Styroflex-Kondensator STYROFLEX-CAPACITOR				
C4,5	2	3120pF	1%	160V	B31861-A1312-F200	
C15,22	2	120pF	1%	160V	B31861-A1121-F	
C17	1	878pF	1%	160V	B31861-A1871-F800	
		Keramik-Kondensator CERAMIC-CAPACITOR				
C6	1	10pF	1%	N075	B38211-J5100-F	
C16,19	2	18,5pF	2%	N075	B38221-J5180-G500	
C33,36	2	1000pF	20%	500V	B37638-B5102-R1	
C37	1	1500pF	20%	500V	B37638-B5152-R1	
		MKL-Kondensator MKL-CAPACITOR				
C27	1	0,1/uF	20%	100V	B32110-E104-M	
		Tantal-Elko TANTAL-ELECTROLYTIC CAP				
C30	1	10/uF	20%	10V	B45170-J1106-M	
C31	1	6,8/uF	20%	35V	B45170-J4685-M	
		Transistor TRANSISTOR				
Ts1,5	2	BCY 78/VIII			Q60203-Y78-H	
Ts2,3,4, 6,7	5	BCY 58/IX			Q60203-Y58-J	
		Zenerdiode ZENER DIODE				
Gr1	1	BZX 55 C6 V8			Q62702-Z572	
Gr2	1	BZX 55 C7 V5			Q62702-Z573	
Gr3	1	1 N 937			Q62702-Z718	
Gr8	1	BAW 75			Q62702-A396	
		Diodenquartett DIODE QUARTET				
Gr4,5,6, 7	1	HP 5082-2805			Q62702-A363-F39	
		Int. Schaltkreis INT. CIRCUIT				
JC1	1	MC 1596-G			Q67000-A535-F6	
JC2	1	TOA 2741 V			Q67000-A153-F11	
Z	1	Relais RELAY			C44303-Z3-C26	

Anzeigelogik S45035-D5298-B701
DISPLAY LOGIC

	1	Anzeigeplatte DISPLAY BOARD	S45035-D5299-B701
		Int. Schaltkreis INT. CIRCUIT	
J15	1	SN 7404 N	Q67000-H153
J5	1	SN 74LS83 N	Q67000-H752
J7	1	SN 7486 N	Q67000-H354
J11,13	2	SN 74L30 N	Q67000-H170
J19,20,22	3	SN 4931 N	Q67000-H140
J8,18	2	SN 7410 N	Q67000-H2
J6,10, 14,16,21	5	SN 7400 N	Q67000-H1
J12	1	SN 7430 N	Q67000-H4
J9	1	SN 74L00 N	Q67000-H167
J17	1	SN 74L10 N	Q67000-H168

Anzeigeplatte S45035-D5299-B701

		Schichtwiderstand LAYER-TYPE RESISTOR				
R1...4	4	22kOhm	5%	0,25W	B51263-A2223-J	
R5...8	4	100kOhm	5%	0,25W	B51263-A2104-J	
R9...12	4	5,6kOhm	5%	0,25W	B51263-A2562-J	
		Diode DIODE				
Gr1...4	4	BAW 75			Q62702-A396	
		Transistor TRANSISTOR				
Ts1..4	4	2 N 3440			Q62702-D5	
		Int. Schaltkreis INT. CIRCUIT				
JC1...4	4	SN 74141 N			Q67000-L1	
		Anzeigeröhre NIXIE				
R82,3,4	3	ZM 1182			Q73-X4874	
R81	1	ZM 1183			Q73-X4882	

Netzteil S45035-D5301-B701
POWER SUPPLY UNIT

	1	Sperrwandler DC/DC INVERTER			S45035-D5302-B701	
Tr	1	Netztrafo MAINS TRANSFORMER			V44221-A3018-A	
L6	1	Entstörglied SUPPRESION FILTER			V44237-K3013-A1	
		Drossel CHOKE				
L7.8	2	11/uH	4A		B82501-B-C18	
		Keramik-Kondensator CERAMIC CAPACITOR				
C1,2,3	3	1/uF	20%	100V	B37968-A1105-M	
C5,6	2	0,47/uF	20%	100V	B37968-A1474-M	
		Tantal-Elko TANTAL-ELECTROLYTIC CAP				
C4	1	22/uF	20%	100V	B45265-A9226-M	
		Duko LEAD THROUGH CAPACITOR				
C8,13	2	5000pF	20%	500V	B37480-B5502-R	
Gr1	1	Klein-Gleichrichter RECTIFIER			C66067-A1730-A2	
		Diode DIODE				
Gr2	1	1 N 1613			Q62702-Y191	
		Sicherung FUSE				
	1	315 mA			D41571-M315-C2	
	1	Netzstecker POWER PLUG			V45257-M3003	
		Elko ELECTROLYTIC CAP				
C10	1	3300/uF	10%	63V	B41453-A8338-T	

Sperrwandler S45035-D5302-B701
DC/DC INVERTER

	1	Sperrwandlerplatte DC/DC INVERTER BOARD			S45035-D5302-S2	
		Schichtwiderstand LAYER-TYPE RESISTOR				
R20	1	2,2 Ohm	5%	0,25W	B54412-A2020-J200	
Ü1	1	Übertrager TRANSFORMER			V44230-H3006	
L5	1	Spule COIL			V44237-K3013	
		MKH-Kondensator MKH-CAPACITOR				
C22	1	0,022/uF	20%	250V	B32220-K3223-M	
		Keramik-Kondensator CERAMIC-CAPACITOR				
C26	1	0,22/uF	20%	100V	B37963-A1224-M3	
		MKL-Kondensator MKL CAPACITOR				
C29	1	3,3/uF	20%	25V	B32110-C3335-M	
		Dufi LEAD THROUGH FILTER				
TP1,2,3	3	2x3500pF	20%	350V	B85313-A-B3	
		Diode DIODE				
Gr15	1	BYX 61-200			Q62702-Y167	
Gr16	1	HP 5082-2835			Q62702-A518-P39	
		Transistor TRANSISTOR				
Ts7	1	BDY 58 SI			Q62702-D214-F10	
		Int. Schaltkreis INT. CIRCUIT				
JC1	1	LM 309 K			Q67000-A258	

Sperrwandlerplatte S45035-D5302-S2
DC/DC INVERTER BOARD

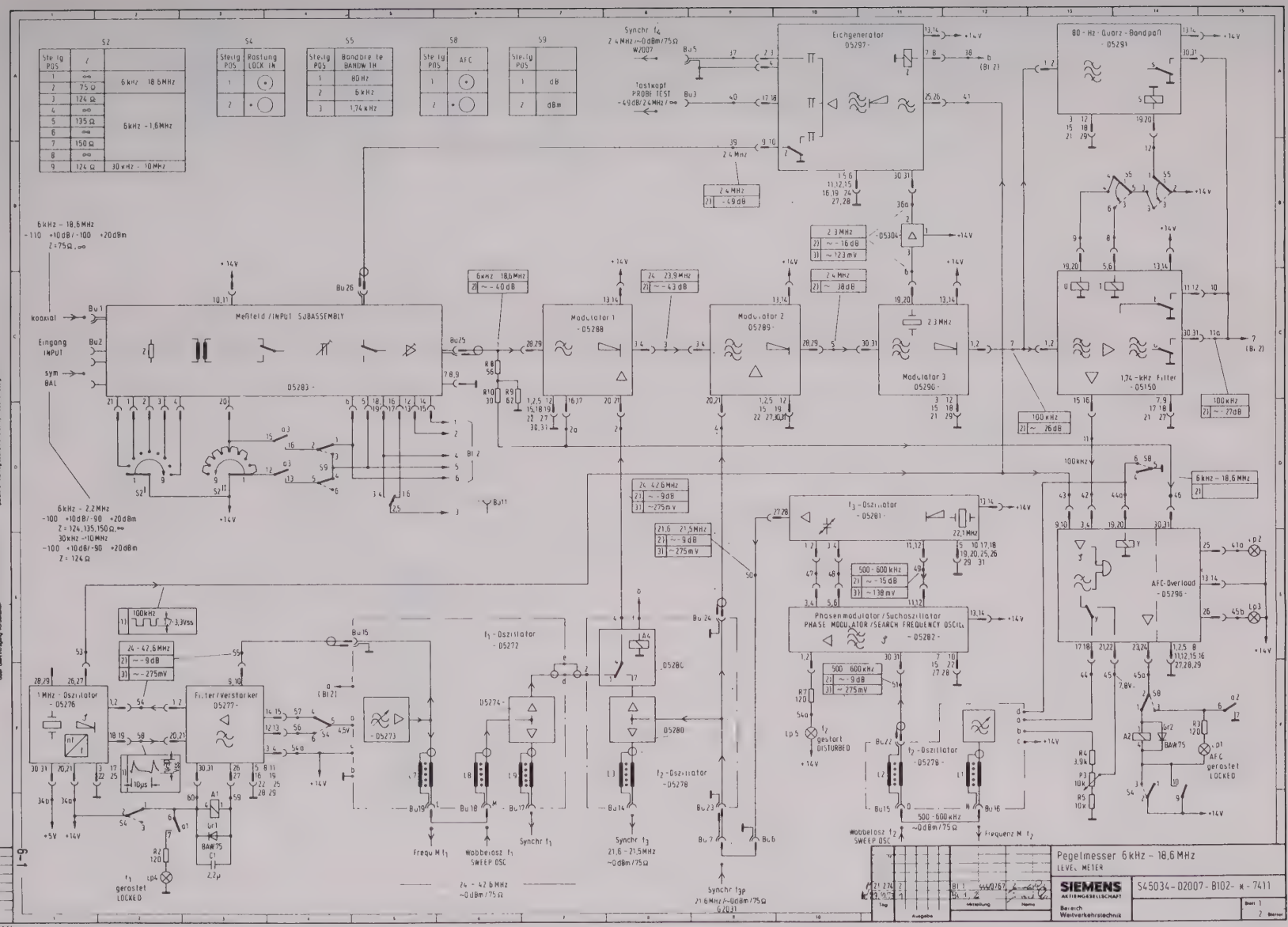
		Schichtwiderstand LAYER-TYPE RESISTOR			
R1	1	27kOhm	5%	0,15W	B51370-A2273-J
R2	1	1kOhm	5%	0,15W	B51370-A2102-J
R3	1	100kOhm	5%	0,15W	B51370-A2104-J
R4	1	2,2kOhm	5%	0,15W	B51370-A2222-J
R5	1	27 Ohm	5%	0,15W	B51370-A2270-J
R8,9	2	100 Ohm	5%	0,15W	B51370-A2101-J
R10	1	330 Ohm	5%	0,15W	B51370-A2331-J
R11	1	27 Ohm	5%	0,15W	B51370-A2270-J
R12	1	560 Ohm	5%	0,15W	B51370-A2561-J
R15	1	27 Ohm	5%	0,15W	B51370-A2270-J
R16	1	100 Ohm	5%	0,15W	B51370-A2101-J
R18	1	4,7kOhm	5%	0,15W	B51262-A2472-J
R19	1	10 Ohm	5%	0,15W	B51262-A2100-J
R22	1	100 Ohm	5%	0,15W	B51262-A2101-J
R24	1	390kOhm	5%	0,25W	B51372-A2394-J
R26	1	2,7kOhm	5%	0,15W	B51370-A2272-J
		Drehwiderstand VAR RESISTOR			
R17	1	1kOhm	20%	lin	W40961-A8102-M
R25	1	470 Ohm	20%	lin	W40961-A8471-M
		Kaltleiter PTC-RESISTOR			
R23	1	Ra=1kOhm			Q63100-P390-C16
		Spule COIL			
L1	1				V44231-C3239
L3	1				V44231-C3248
L4	1	25/uH	1A		B82501-A-C25
		Tantal-Elko TANTAL-ELECTROLYTIC CAP			
C9	1	68/uF	20%	60V	B45265-A7686-M
C11	1	10/uF	20%	25V	B45265-A4106-M
C16	1	33/uF	20%	10V	B45170-A1336-M
C17	1	0,68/uF	20%	75V	B45170-A7684-M
C23,24	2	180/uF	20%	25V	B45265-A4187-M
C25	1	100/uF	20%	25V	B45265-A4107-M
C30,31	2	220/uF	20%	25V	B45265-A1227-M
		Elko ELECTROLYTIC CAP			
C18,19	2	2,2/uF	10%	250V	B44514-J2225-Q
		Keramik-Kondensator CERAMIC CAPACITOR			
C12	1	1500pF	20%	500V	B37638-B5152-R1
C15	1	500pF	20%	500V	B37635-B5501-R1
		Zenerdiode ZENER DIODE			
Gr3	1	BZX 55 C27			Q62702-Z847
Gr4	1	BZX 55 C6 V2			Q62702-Z571
Gr19	1	BZX 55 C6 V8			Q62702-Z572
		Diode DIODE			
Gr5,8,11	3	FDH 400			Q68000-A253-F72
Gr9,10, 17,18	4	BAW 75			Q62702-A396
Gr22	1	1 N 4933			Q62702-A423
Gr12	1	BY 203/16			V42292-Z8
		Transistor TRANSISTOR			
Ts1	1	2 N 3819			Q62702-C51-F9
Ts3	1	BCY79/ VIII			Q60203-Y79-H
Ts2	1	BCY 59/ IX			Q60203-Y59-J
Ts4	1	BFX 34			Q60206-X34
Ts5	1	BCY 78/VIII			Q60203-Y78-H
Ts6	1	2 N 2218 A			Q62702-S29

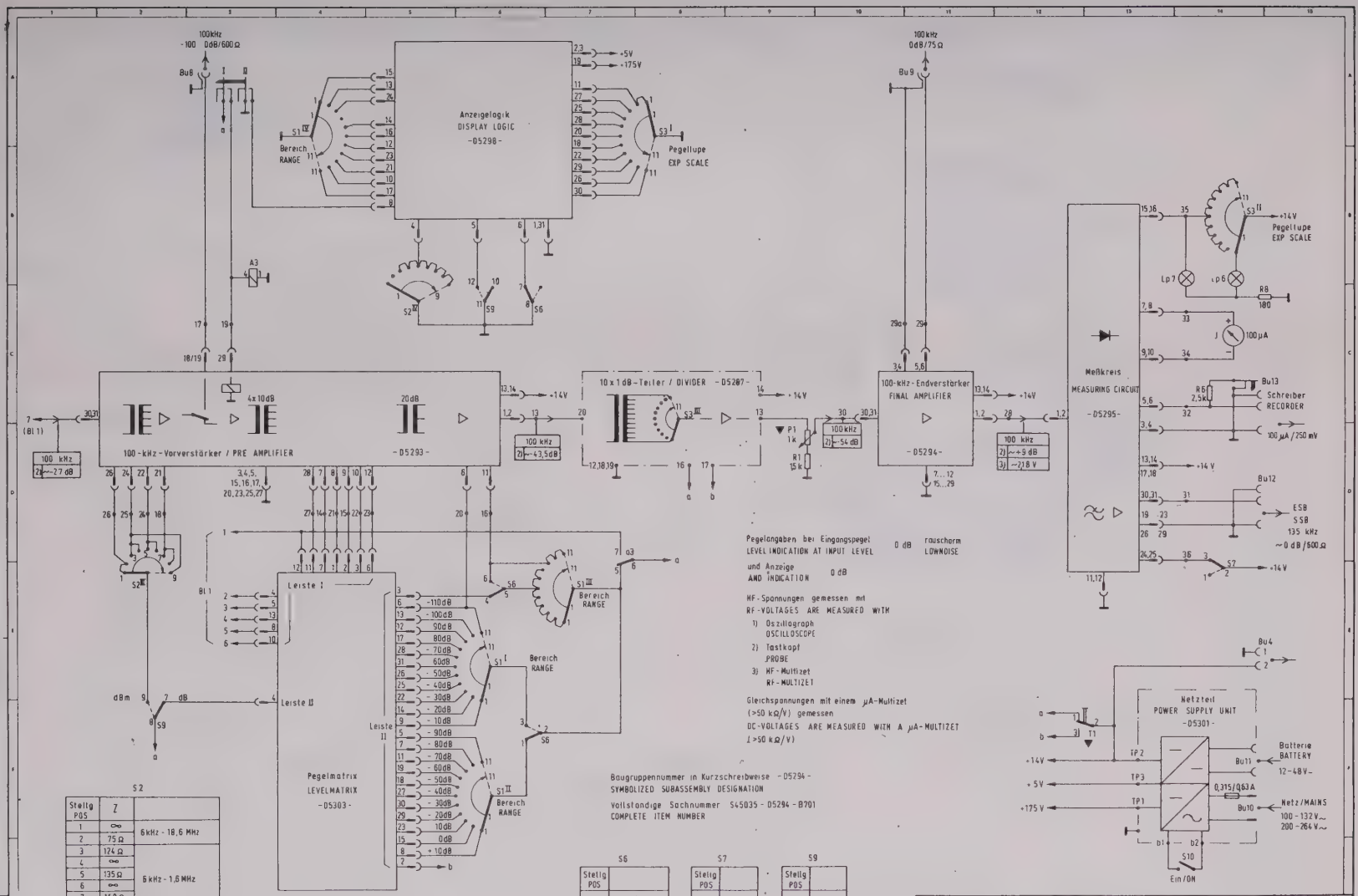
Pegelmatrix S45035-D5303-A701
LEVELMATRIX

		Diode DIODE	
Gr1...66	66	BAW 75	Q62702-A396

Trennverstärker 2,4MHz S45035-D5304-A701
BUFFER AMPLIFIER

		Schichtwiderstand LAYER-TYPE RESISTOR			
R1,2	2	10kOhm	5%	0,15W	B51262-A2103-J
R3	1	100 Ohm	5%	0,15W	B51262-A2101-J
R4	1	470 Ohm	5%	0,15W	B51262-A2471-J
R5	1	3kOhm	5%	0,15W	B51262-A2302-J
		Keramik-Kondensator CERAMIC CAPACITOR			
C1,4	2	1000pF	20%	500V	B37638-B5102-R1
C3	1	5pF		0,5pF	B38212-A5050-D
		MKL-Kondensator MKL-CAPACITOR			
C2	1	0,1/uF	20%	100V	B32110-E104-M
		Transistor TRANSISTOR			
Ts1	1	BCY 58/VIII			Q60203-Y58-H


S2
S4
S5
S8
S9
Eingangsgenerator 05297
80-Hz-Quarz-Bandpaß - 05291
Meßfeld/INPUT SUBASSEMBLY - 05283
Modulator 1 - 05288
Modulator 2 - 05289
Modulator 3 - 05290
1,74-kHz Filter - 05150
AFC-Overload - 05296
f3-Oszillator - 05281
Phasenmodulator/Suchoszillator - 05282
1 MHz-Oszillator - 05276
Filter/Verstärker - 05277
f1-Oszillator - 05272
f2-Oszillator - 05278
Pegelmesser 6kHz - 18,6MHz
LEVEL METER
SIEMENS AKTIENGESELLSCHAFT
Bereich Weitverkehrstechnik
S45034-D2007-B102-*-7411



Pegelmesser 6kHz - 18,6 MHz
LEVEL METER

SIEMENS AKTIENGESELLSCHAFT
Bereich Wehrverkehrstechnik

S45034-D2007-B102-*-7411

Blatt 2

6-3

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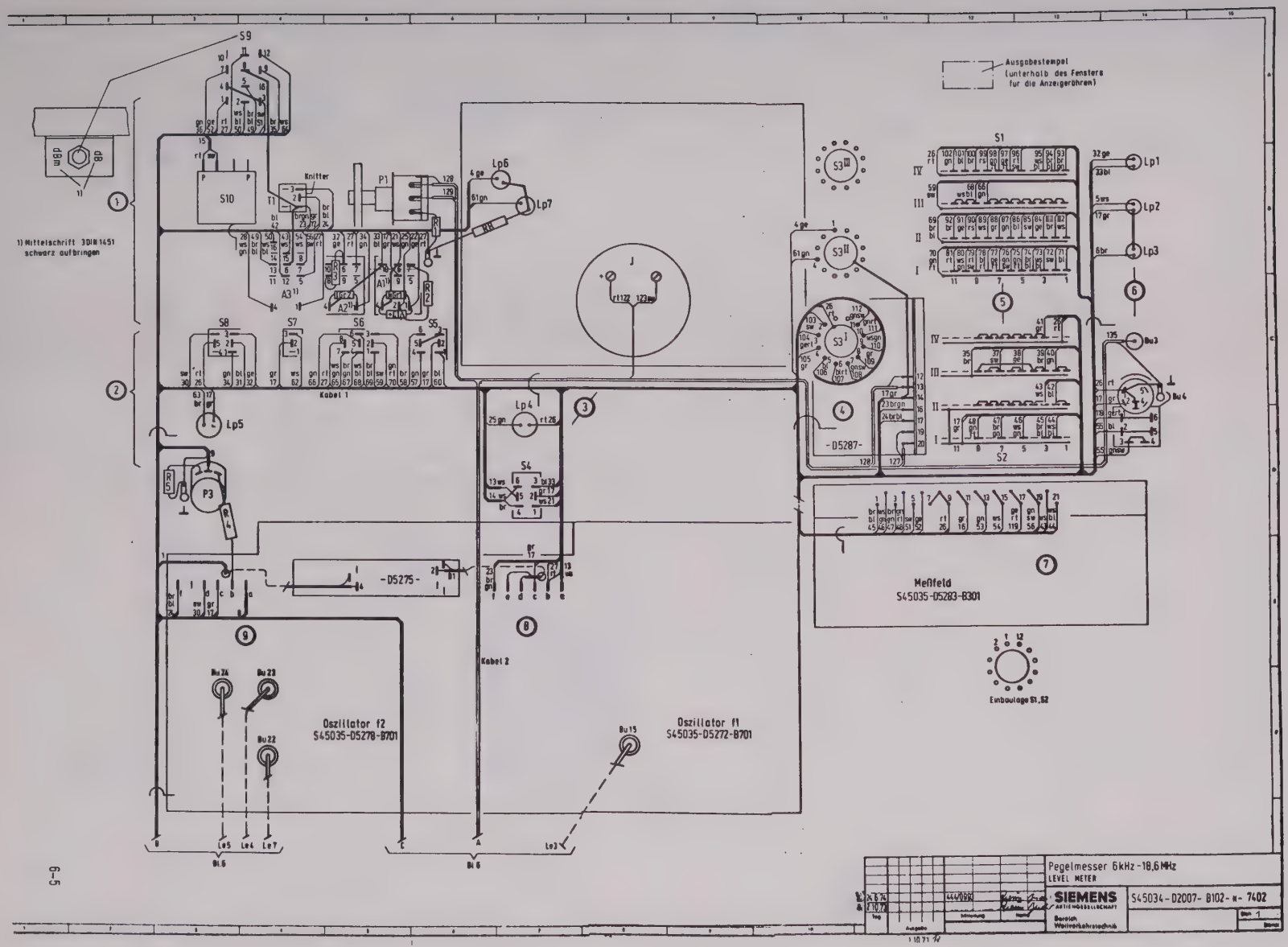
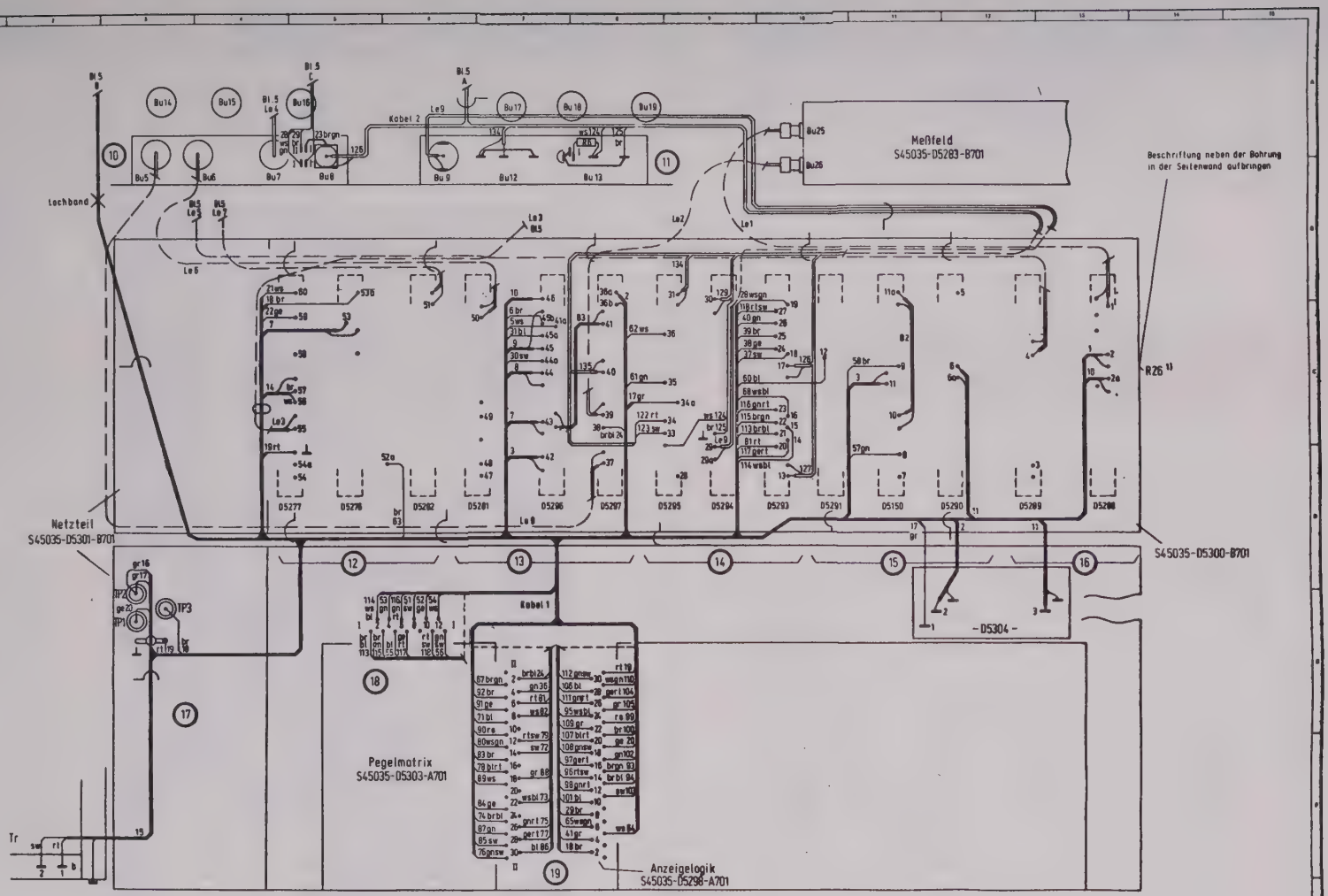

Ausgabestempel
(unterhalb des Fensters
für die Anzeigeröhren)
1) Mittelschrift 3DIN 1451
schwarz aufbringen
Kabel 1
Kabel 2
-D5287-
-D5275-
Meßfeld
S45035-D5283-B301
Einbaulage S1, S2
Oszillator f2
S45035-D5278-B701
Oszillator f1
S45035-D5272-B701
Bl 6
Bl 6
Pegelmesser 6kHz-18,6MHz
LEVEL METER
SIEMENS
AKTIENGESELLSCHAFT
S45034-D2007-B102-W-7402

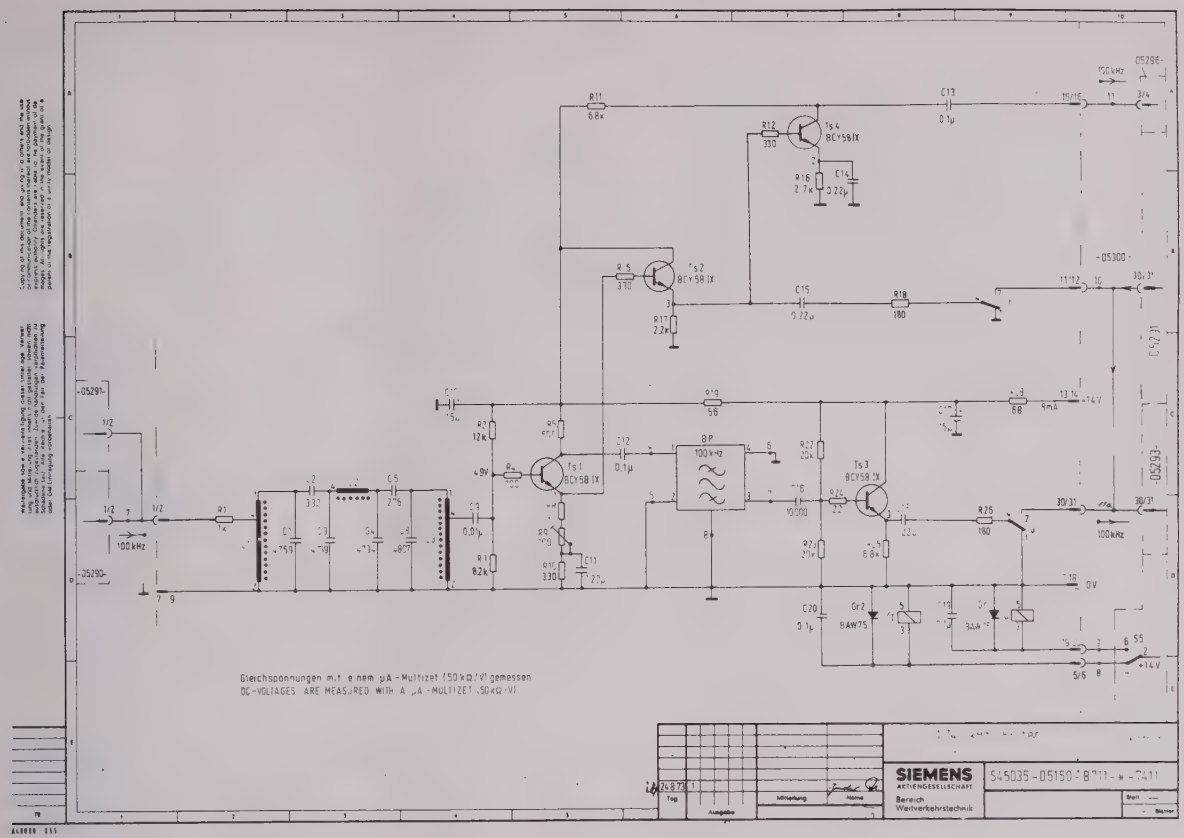


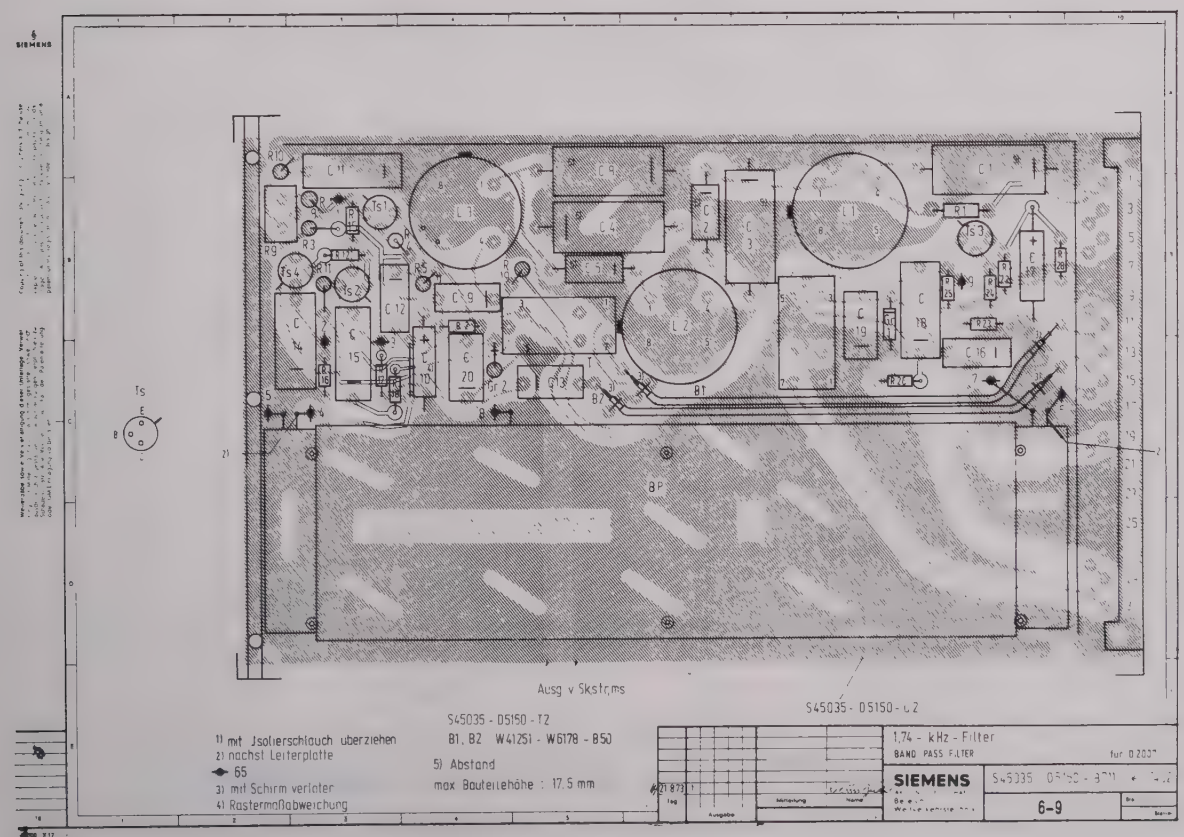
Pegelmesser 6 kHz - 18,6 MHz
LEVEL METER

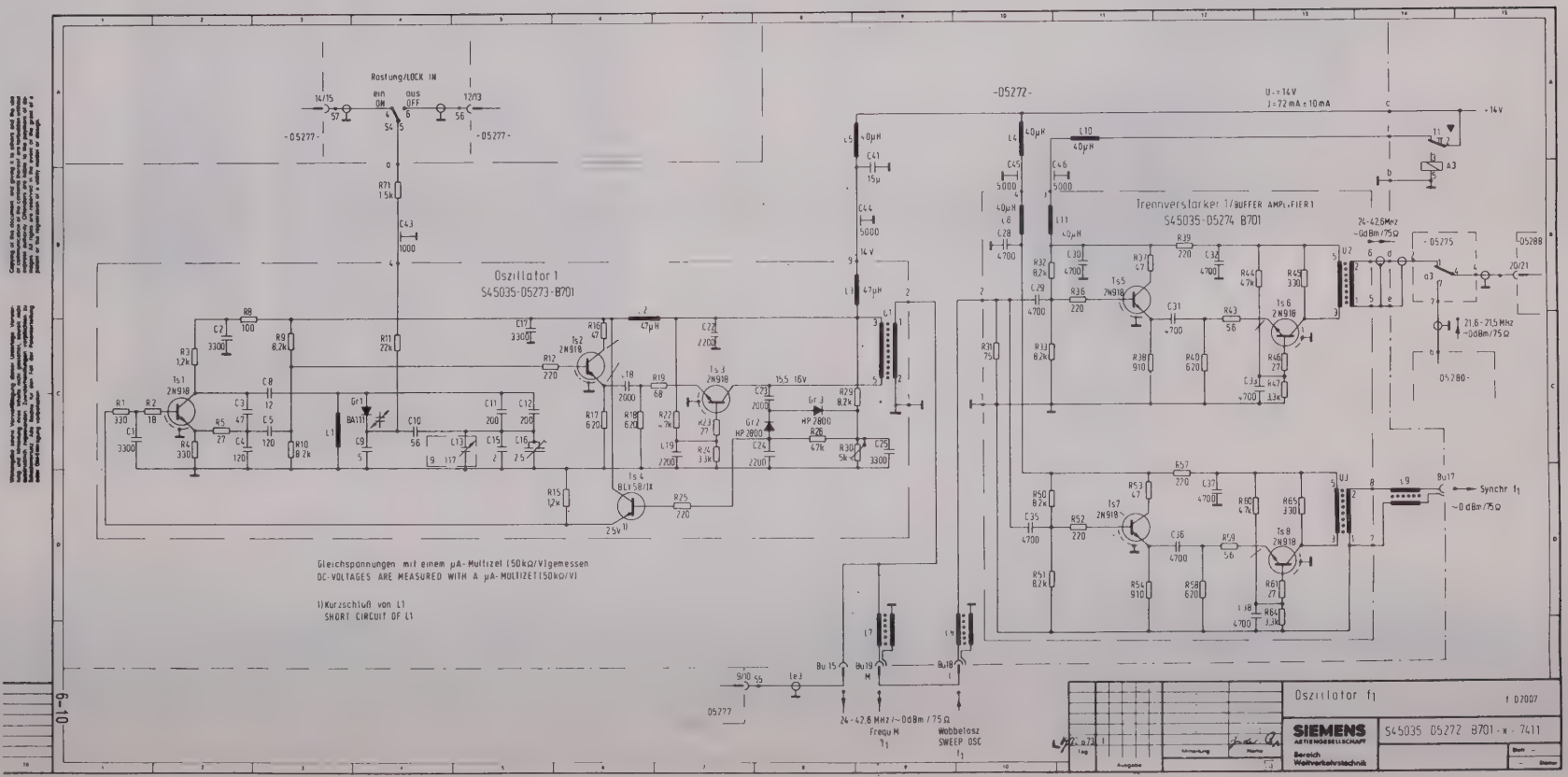
SIEMENS AKTIENGESELLSCHAFT
Bereich Weitverkehrstechnik

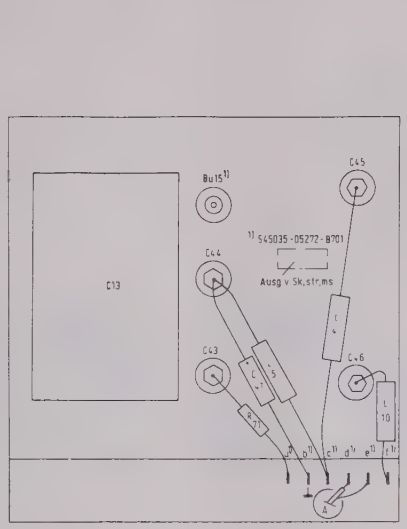
S45034-D2007-B102-B-7402

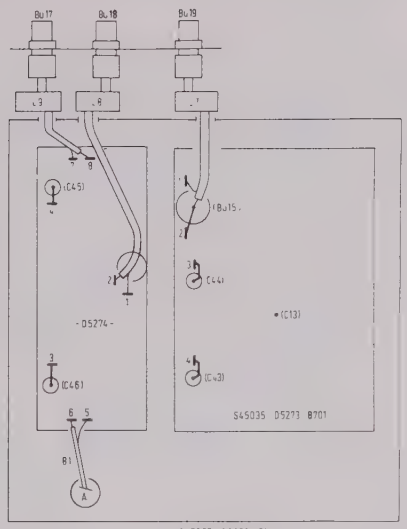
6-7


Gleichspannungen mit e nem µA-Multizet (50 kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50KΩ/V)
SIEMENS
AKTIENGESELLSCHAFT
Bereich Weitverkehrstechnik
S45035-D5150-B711-*-7411


Ausg v Skstrms
S45035 - D5150 - U2
S45035 - D5150 - T2
B1, B2 W41251 - W6178 - B50
1) mit Isolierschlauch überziehen
2) nächst Leiterplatte
3) mit Schirm verlöter
4) Rastermaßabweichung
5) Abstand
max Bauteilehöhe : 17.5 mm
1,74 - kHz - Filter
BAND PASS FILTER
SIEMENS
6-9


Rastung/LOCK IN
ein ON
aus OFF
14/15
12/13
- 05277 -
- 05277 -
S4
R71 1,5k
C43 1000
Oszillator 1
S45035-05273-B701
L5 40µH
C41 15µ
C44 5000
14 V
L3 47µH
L1
C17 3300
R16 47
Ts2 2N918
R12 220
47µH
C22 2200
.18
R19 68
Ts3 2N918
15,5 16V
C23 2000
Gr3
R29 8,2k
Gr2
HP 2800
R26 47k
C24 2200
R30 5k
C25 3300
R23 77
R24 33k
L19 2200
Ts4 BLY58/IX
R15 1,2k
R25 220
2,5V 1)
R1 330
R2 18
Ts1 2N918
R3 1,2k
R4 330
C1 3300
C2 3300
R8 100
R9 8,2k
C3 12
C4 120
R5 27
C5 47
C8
R10 8,2k
Gr1 BA111
L1
C9 5
C10 56
C11 200
C12 200
C13 2
C15 2
C16 25
L9 117
Gleichspannungen mit einem µA-Multizet (50kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET(50kΩ/V)
1) Kurzschluß von L1
SHORT CIRCUIT OF L1
-05272-
U = 14V
I = 72mA ± 10mA
+14V
L4 40µH
L10 40µH
C45 5000
C46 5000
40µH
L8
C28 4700
L11 40µH
Trennverstärker 1/BUFFER AMPLIFIER 1
S45035-05274-B701
R39 220
C30 4700
C32 4700
R32 8,2k
R37 47
Ts5 2N918
C29 4700
R36 220
C31 700
R43 56
Ts6 2N918
R44 47k
R45 330
U2
R31 75
R33 8,2k
R38 910
R40 620
R46 27
C33 4700
47k
33k
24-42,6MHz ~0dBm/75Ω
- 05275
05288
20/21
21,6-21,5MHz ~0dBm/75Ω
05280
R57 270
C37 4700
R50 8,2k
R53 47
Ts7 2N918
R52 220
C35 4700
C36 4700
R49 56
Ts8 2N918
R60 47k
R65 330
U3
L9
Bu17
Synchr f1
~0dBm/75Ω
R51 8,2k
R54 910
R58 620
R61 27
C38 4700
R64 3,3k
Bu 15
Bu19 M
Bu18 I
L7
L8
SK10 55
L8 J
05277
24-42,8 MHz/~0dBm/75Ω
Frequ M
f1
Wobbelosz
SWEEP OSC
f1
Oszillator f1
f 02007
SIEMENS
AKTIENGESELLSCHAFT
Bereich Weitverkehrstechnik
S45035 05272 B701-x-7411
Blatt -
Blätter
Änderung
Name
Ausgabe
Tag
6-10
849000-257





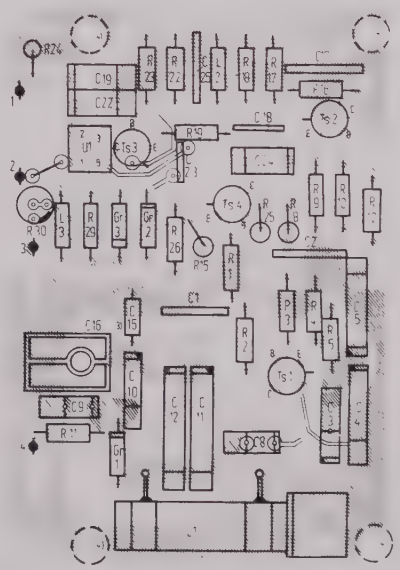
S45035-D5272-T1
B1 W41251-W8179-B75

1) Mittelschrift 3,0 N 1451 schwarz aufbringen
Herstellungszeichen an beliebiger Stelle

Oszillator f1

SIEMENS
AKTIENGESELLSCHAFT
Bereich Weitverkehrstechnik

S45035-D5272-B1



75

3) Mit Warmeableitung einlaten, nicht im Rastermaß
4) 7mm ⌀ frei von Lötzinn Rastermaßabweichung

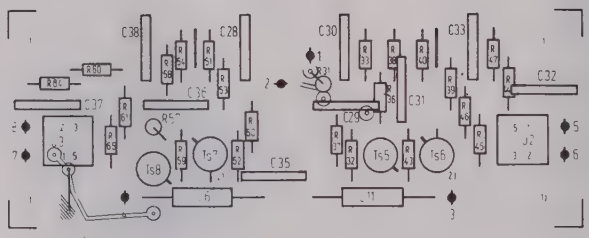
S45035-W5137-

Oszillator 1
OSCILLATOR 1

SIEMENS

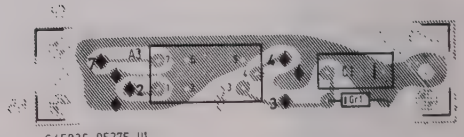
S45035-D5273-

6-11



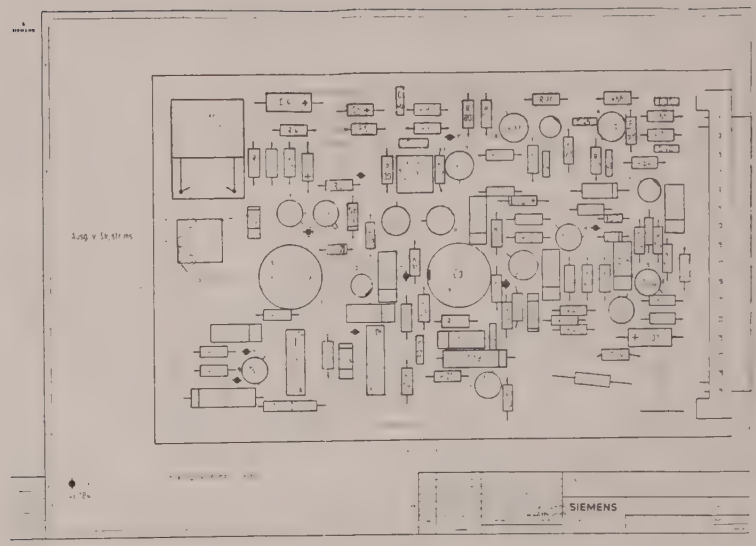
S45035-D5280-U1

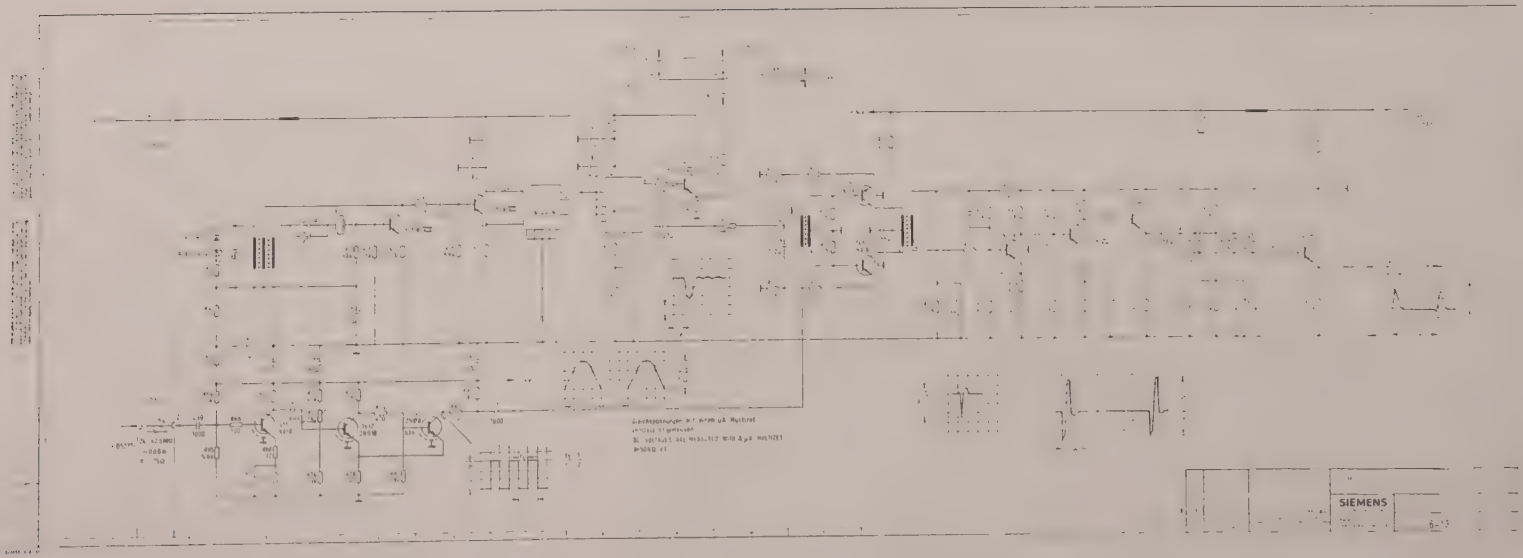
Trennverstärker T_1 für D2007
BUFFER AMPLIFIER
SIEMENS S45035-D5274-A701-*-7402

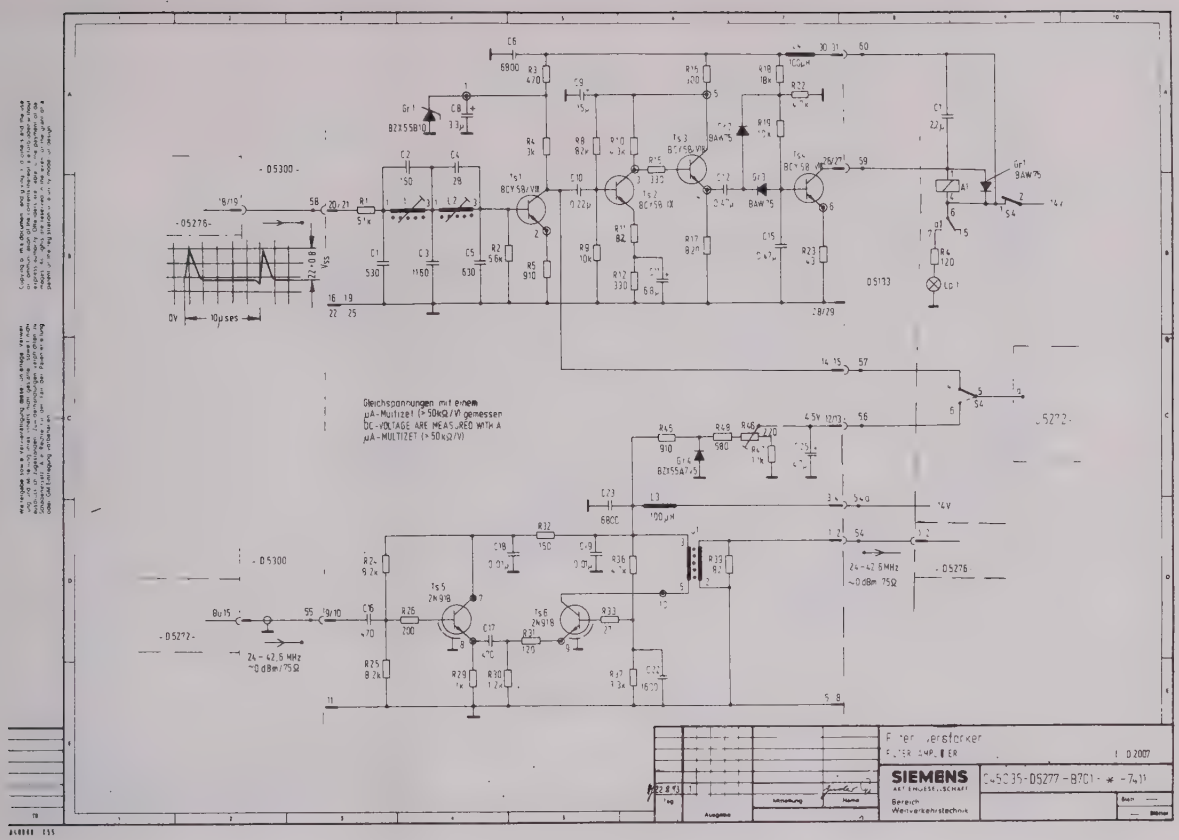


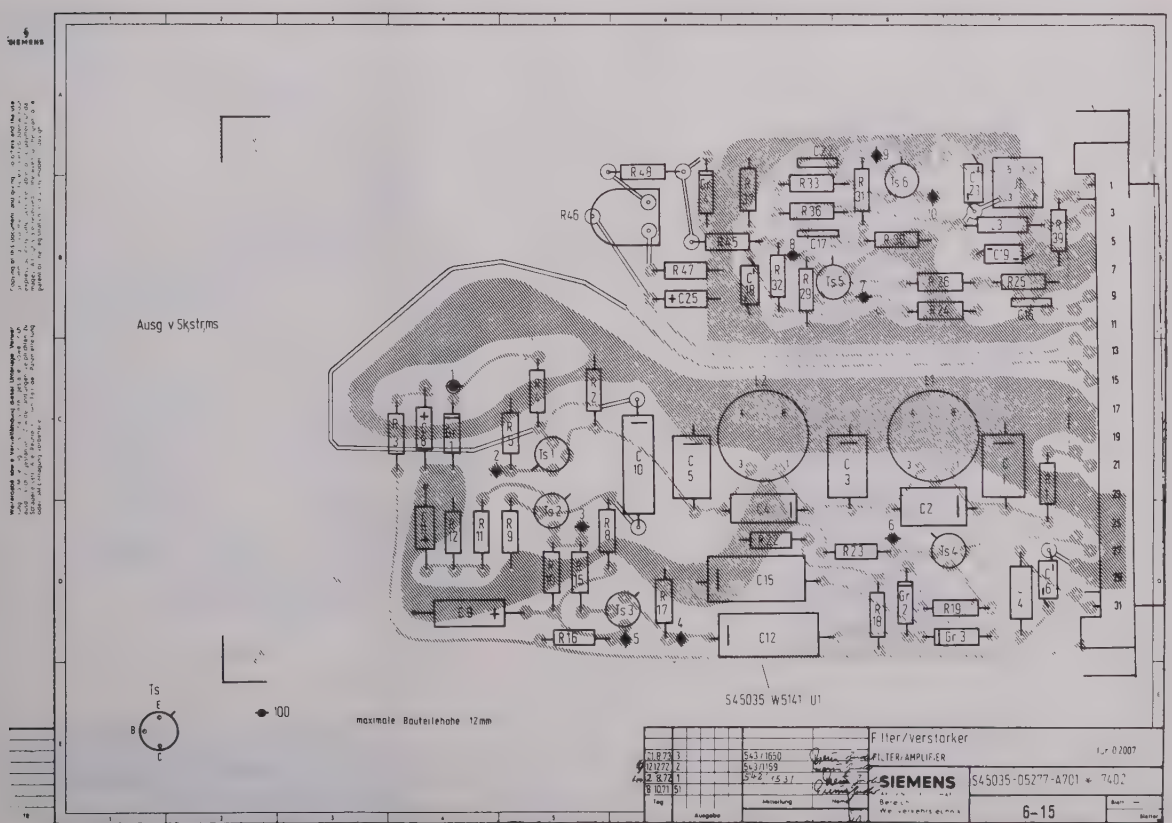
S45035-D5275-U1

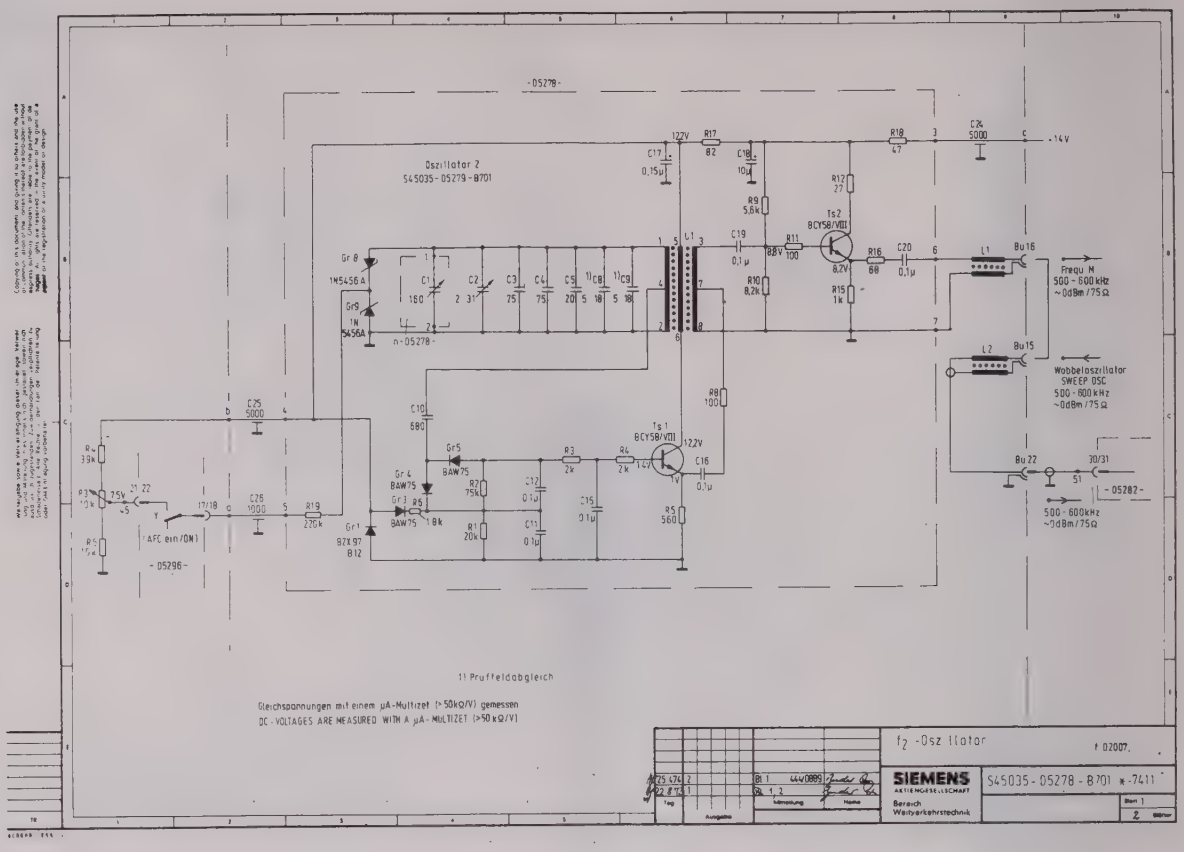
Relais-Platte für D2007
RELAY BOARD
SIEMENS AKTIENGESELLSCHAFT
S45035-D5275-B701-*-7402
6-12

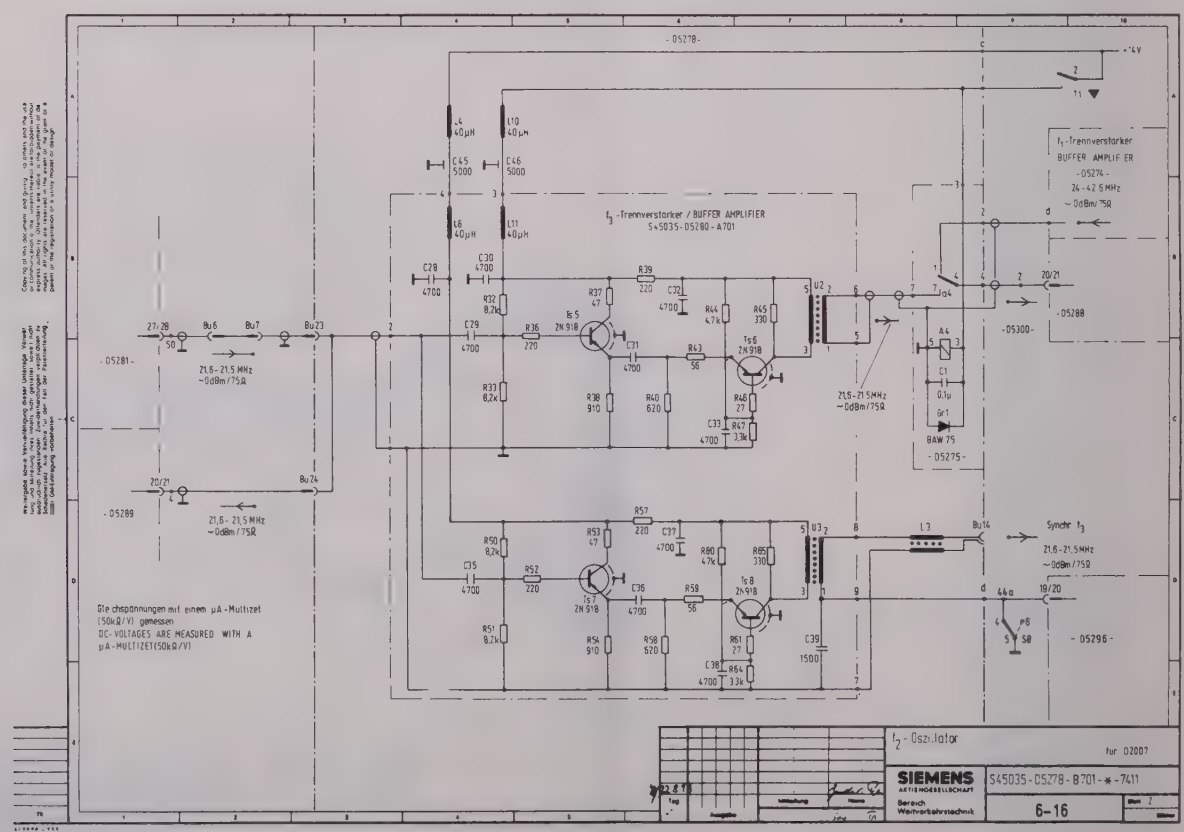

SIEMENS

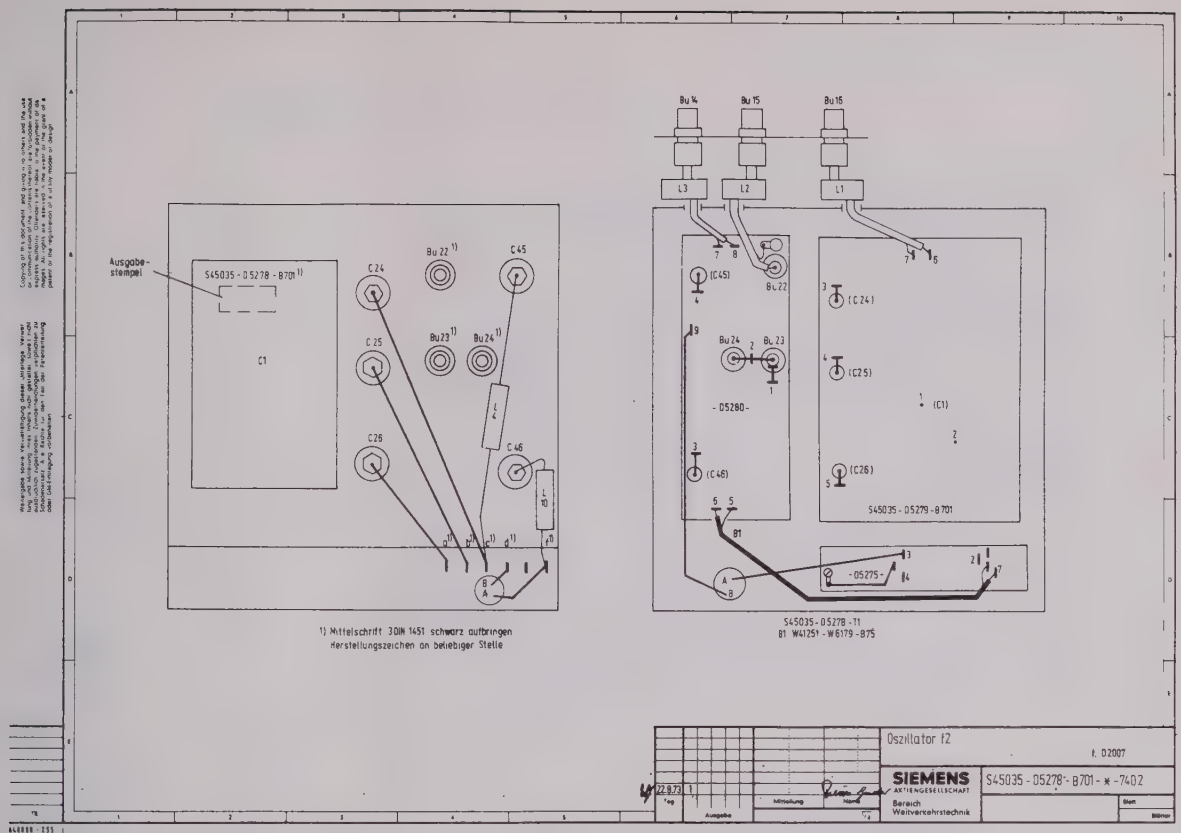

SIEMENS

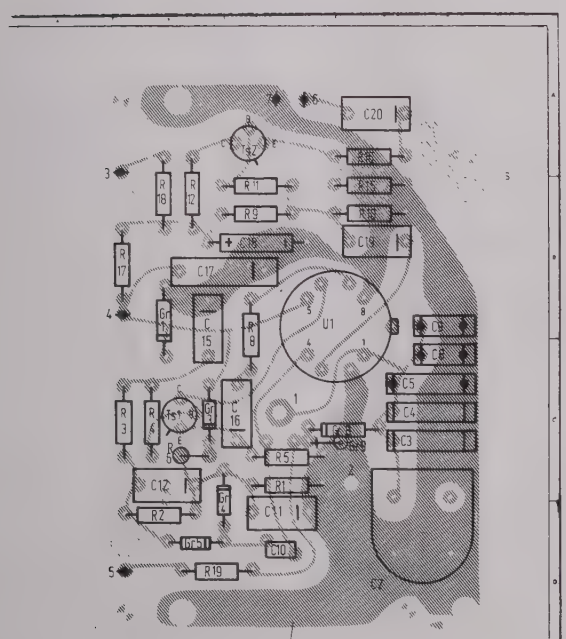

Gleichspannungen mit einem
µA-Multizet (> 50kΩ/V) gemessen
DC-VOLTAGE ARE MEASURED WITH A
µA-MULTIZET (> 50kΩ/V)
Z4 ~ 42,6 MHz
~0 dBm/75Ω
Z4 ~ 42,6 MHz
~0 dBm 75Ω
- 05300 -
- 05276 -
- 05272 -
- 05273 -
- 05279 -
- 05278 -
SIEMENS
Filter Verstärker
FILTER AMPLIFIER
S45035-D5277-B701 - * - 7411

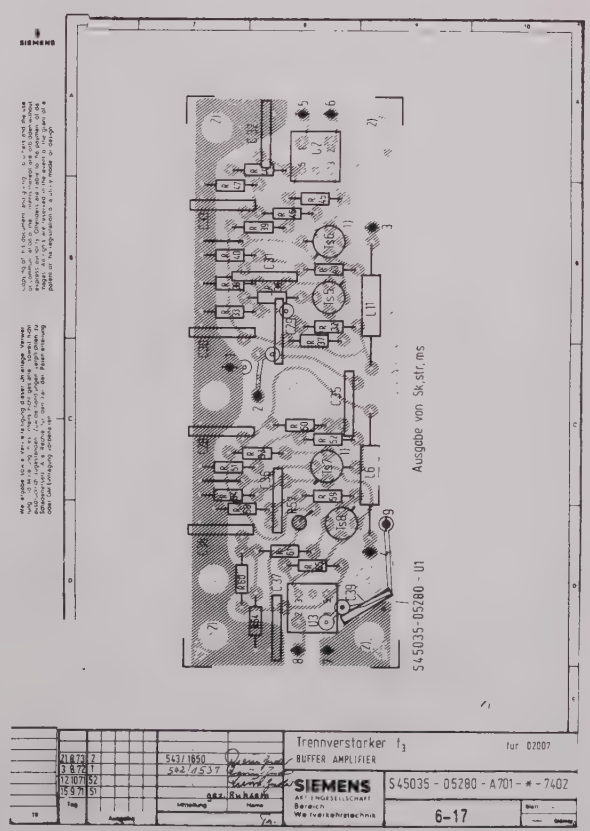

Ausg v Skstrms
maximale Bauteilehöhe 12mm
S45035 W5141 U1
Filter/Verstärker
FILTER/AMPLIFIER
SIEMENS
S45035-D5277-A701 * 7402
6-15

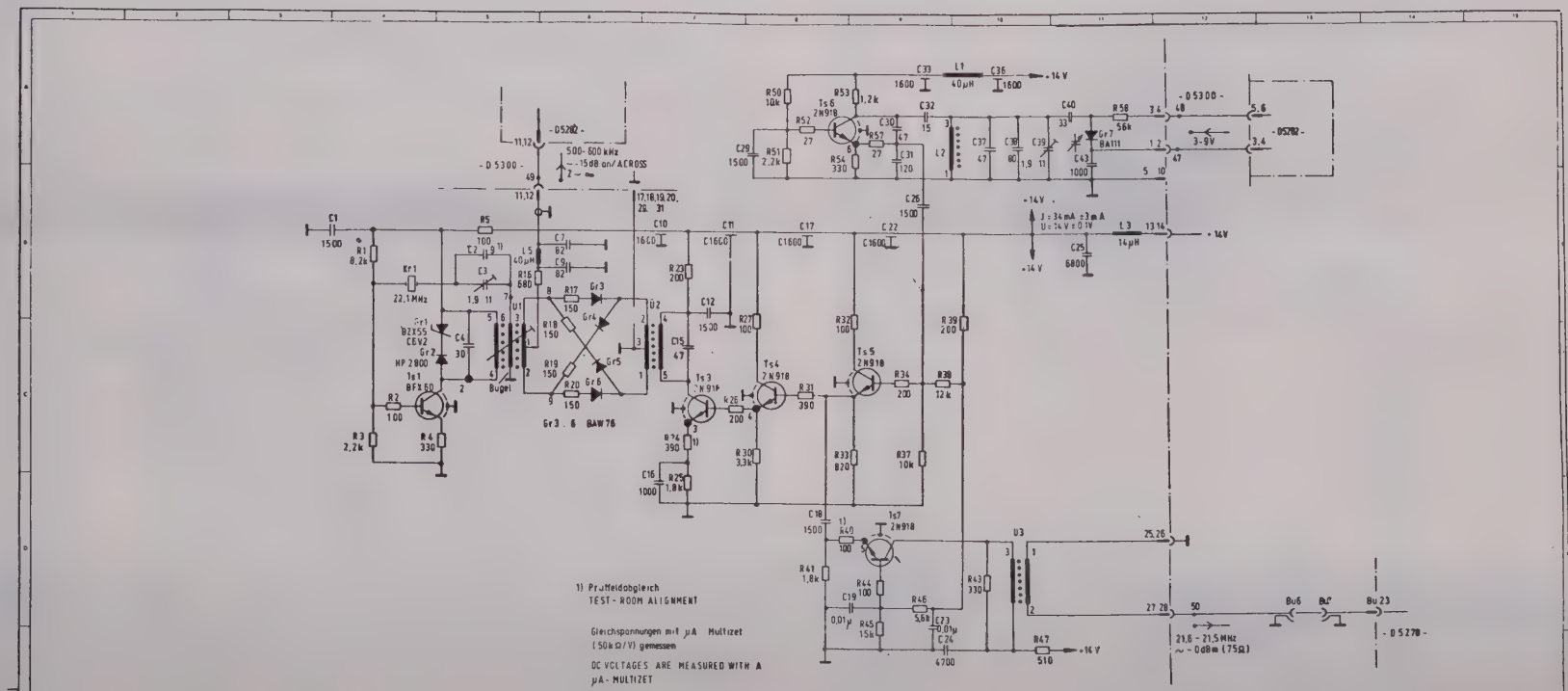

- 05278 -
Oszillator 2
S45035-05279-B701
Gr8 1N5456A
Gr9 1N 5456A
Gr1 BZX97 B12
Gr2 BAW75
Gr3 BAW75
Gr4 BAW75
Gr5 BAW75
Ts1 BCY58/VIII
Ts2 BCY58/VIII
Frequ M 500 - 600 kHz ~0dBm/75Ω
Wobbeloszillator SWEEP OSC 500 - 600 kHz ~0dBm/75Ω
500 - 600 kHz ~0dBm/75Ω
AFC ein/ON
- 05296 -
- 05282 -
1) Prüffeldabgleich
Gleichspannungen mit einem µA-Multizet (> 50kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (>50 kΩ/V)
f2 - Oszillator
für D2007
SIEMENS
AKTIENGESELLSCHAFT
Bereich Wehrverkehrstechnik
S45035-05278-B701-*-7411
Blatt 1
2

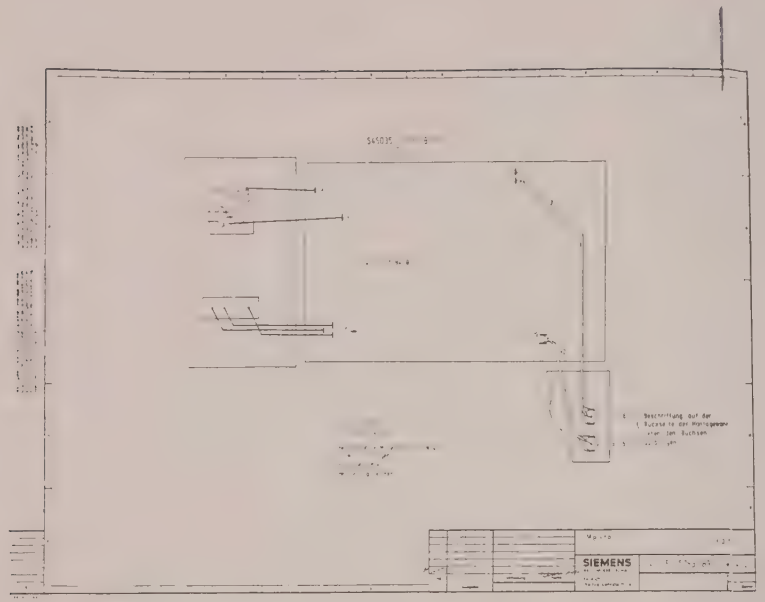

- 05278 -
f3 - Trennverstärker / BUFFER AMPLIFIER S45035-05280-A701
f3 - Trennverstärker BUFFER AMPLIFIER - 05274 - 24 - 42,5 MHz ~0dBm/75Ω
- 05281 -
- 05289 -
- 05288 -
- 05300 -
- 05275 -
- 05296 -
21,6 - 21,5 MHz ~0dBm/75Ω
Synchr f3
Gleichspannungen mit einem µA-Multizet (50kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET(50kΩ/V)
f2 - Oszillator
für D2007
SIEMENS
AKTIENGESELLSCHAFT
Bereich Wehrverkehrstechnik
S45035-05278-B701-*-7411
6-16
Blatt 2

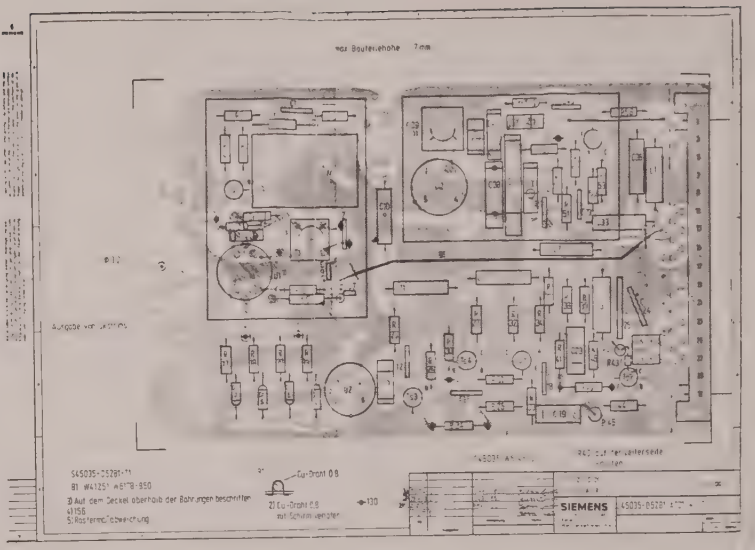

Ausgabe-
stempel
S45035 - D5278 - B701 1)
C1
C24
C25
C26
Bu 22 1)
Bu23 1)
Bu24 1)
C45
C46
Bu 14
Bu 15
Bu 16
L3
L2
L1
(C45)
Bu 22
(C 24)
Bu 24
Bu 23
(C25)
(C1)
- D5280 -
(C46)
(C26)
S45035 - D5279 - B701
B1
- D5275 -
1) Mittelschrift 30IN 1451 schwarz aufbringen
Herstellungszeichen an beliebiger Stelle
S45035 - D5278 - 11
B1 W41251 - W6179 - B75
Oszillator f2
t. D2007
SIEMENS
AKTIENGESELLSCHAFT
Bereich
Weitverkehrstechnik
S45035 - D5278 - B701 - * - 7402

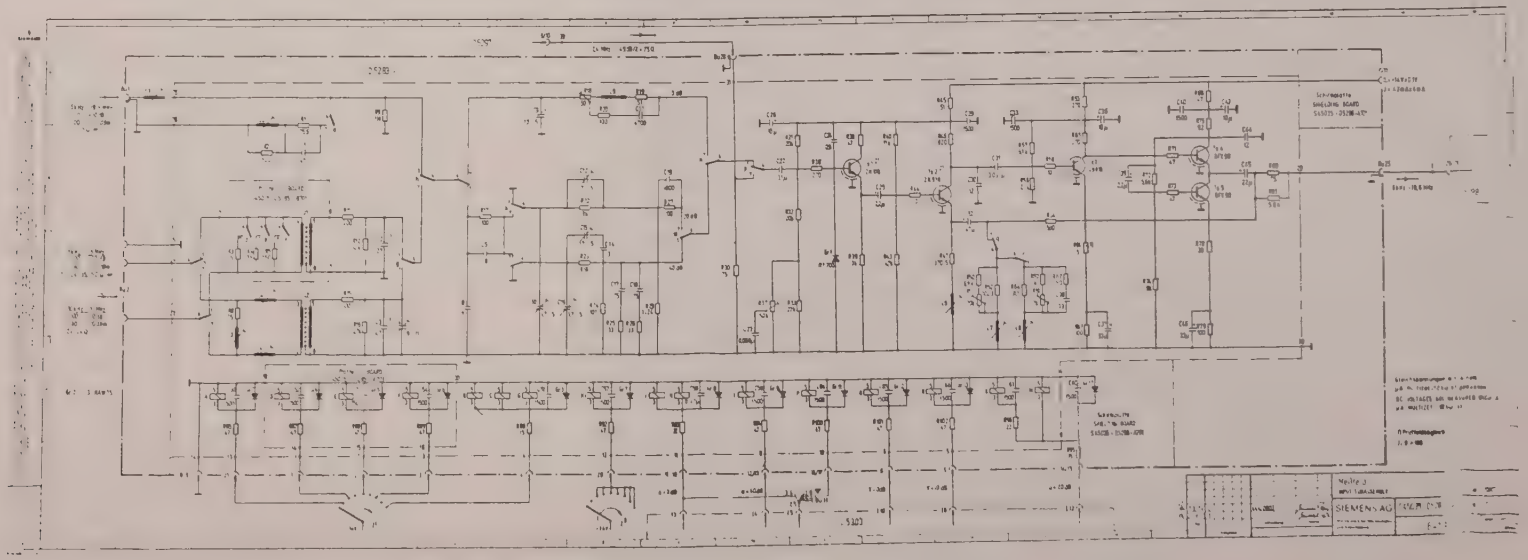

C20
R18
R12
R17
R7
R9
C19
C17
C15
C16
U1
C6
C5
C4
C3
R5
R1
C12
R2
C11
R19
C10
C7
S45035 - W5143 - U1
Oszillator 2
tur D 2007
SIEMENS
AKTIENGESELLSCHAFT
S45035 - D5279 - A701 - * - 7402

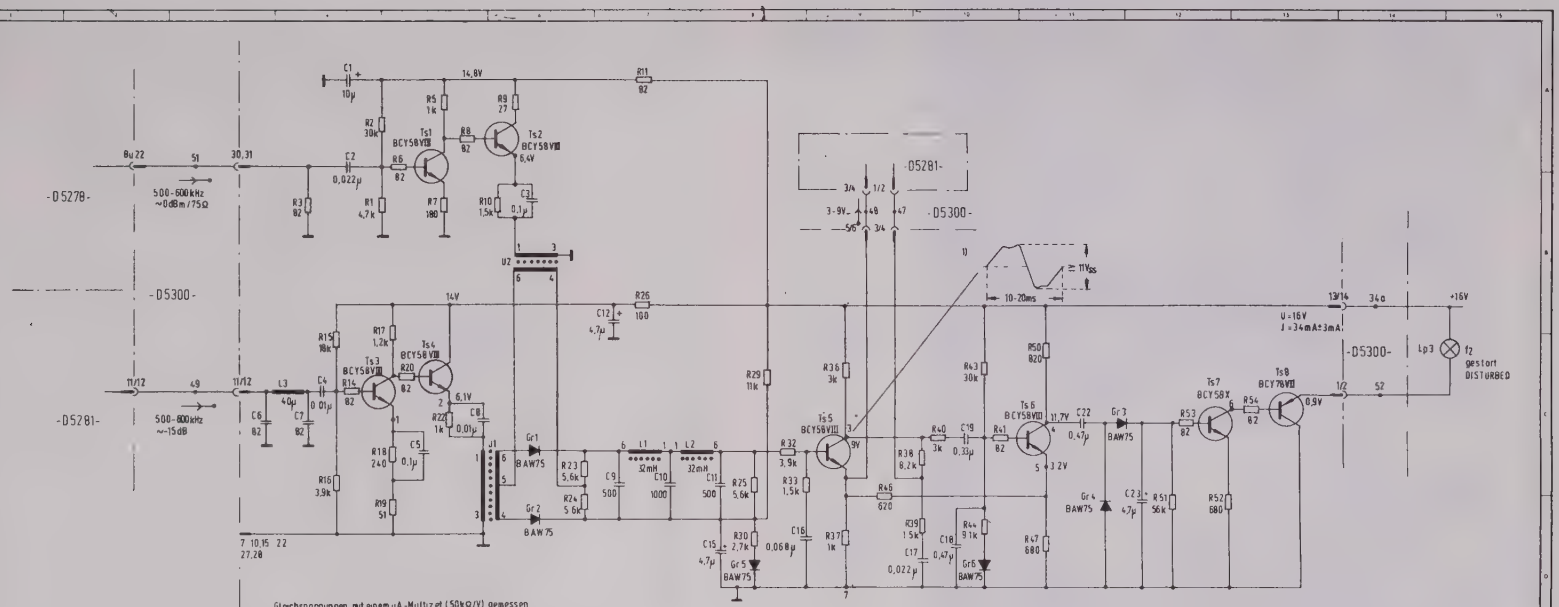

Ausgabe von Sk.str.ms
S45035-D5280 - U1
Trennverstärker t3
BUFFER AMPLIFIER
tur D2007
SIEMENS
AKTIENGESELLSCHAFT
Bereich
Weitverkehrstechnik
S45035 - D5280 - A701 - * - 7402
6-17


1) Prüffeldabgleich
TEST - ROOM ALIGNMENT
Gleichspannungen mit µA Multizet
(50 kΩ/V) gemessen
DC VOLTAGES ARE MEASURED WITH A
µA - MULTIZET
f3 - Oszillator
f3 - OSCILLATOR
SIEMENS
AKTIENGESELLSCHAFT
Bereich Wehrverkehrstechnik
S45035 - D5281 - B701 - * - 7411
6-18


SIEMENS


SIEMENS





Phasenmodulator/Suchoszillator
PHASE MODULATOR/SEARCH FREQUENCY OSCILLATOR f 02007

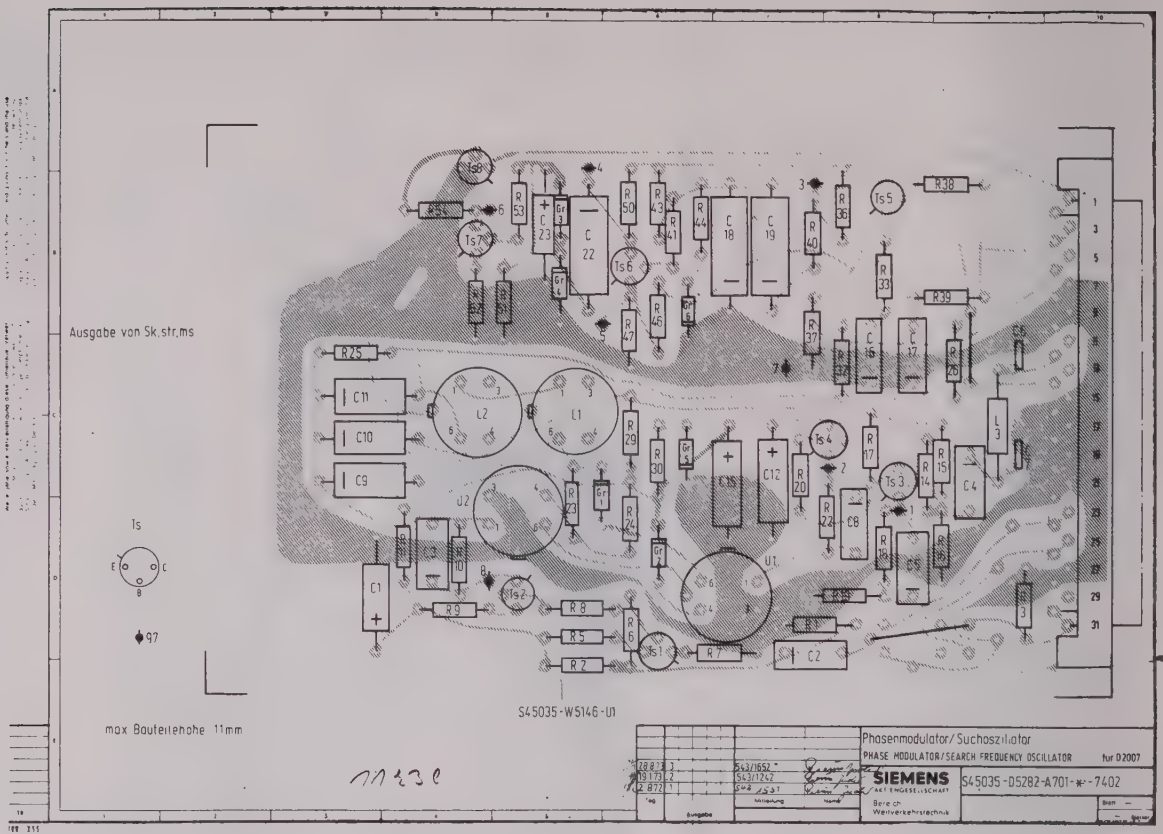
SIEMENS AKTIENGESELLSCHAFT
Bereich Weitverkehrstechnik

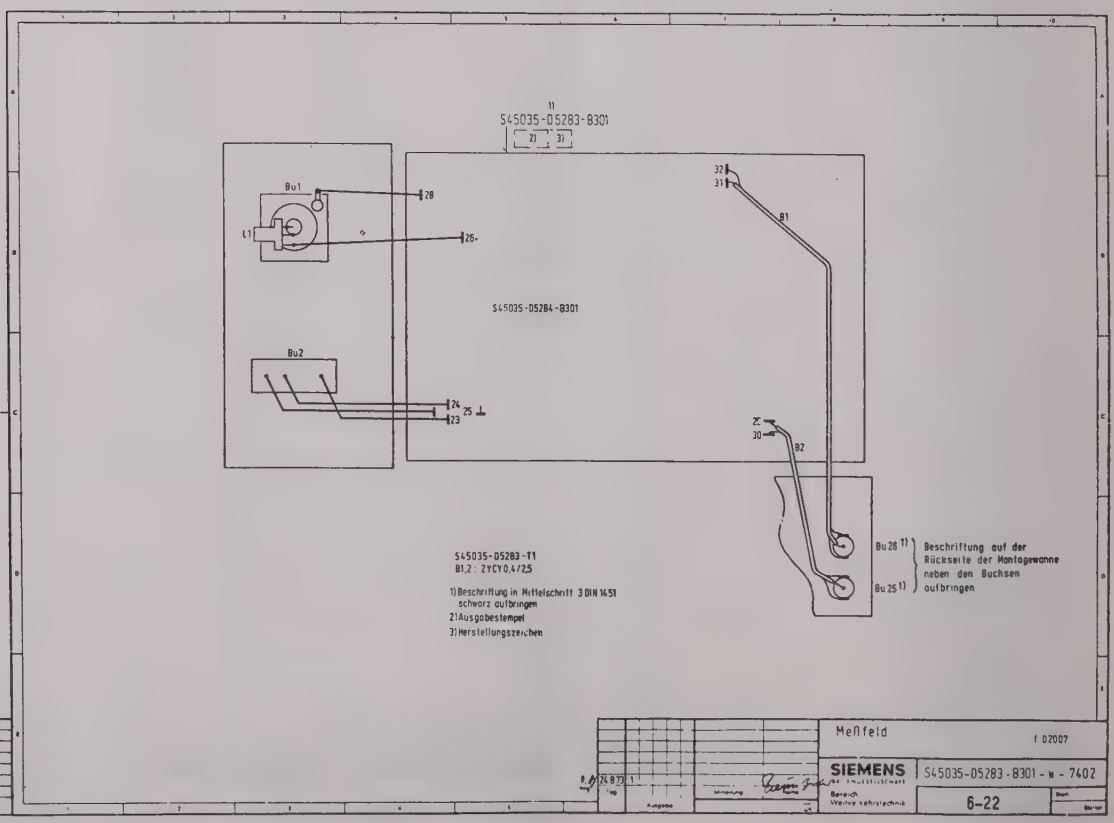
S45035-D5282-A701-x-7411

Blatt — Blätter

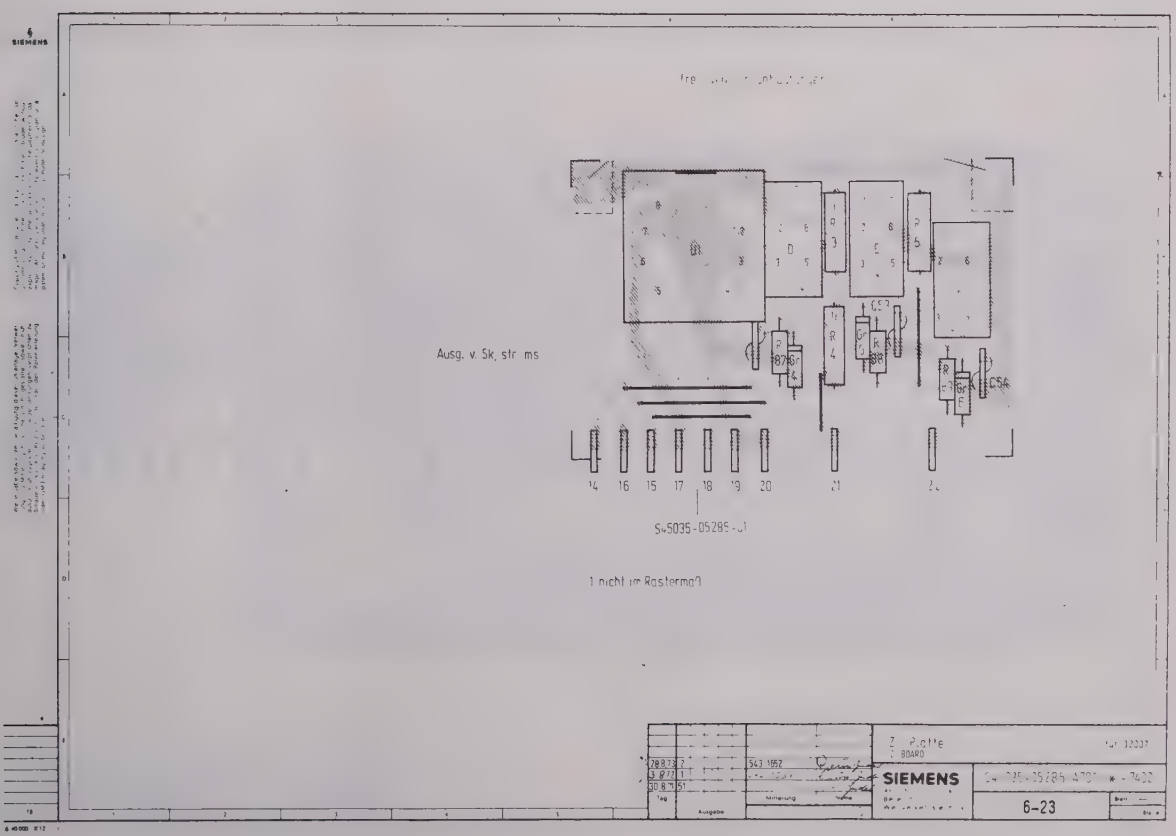
6-21

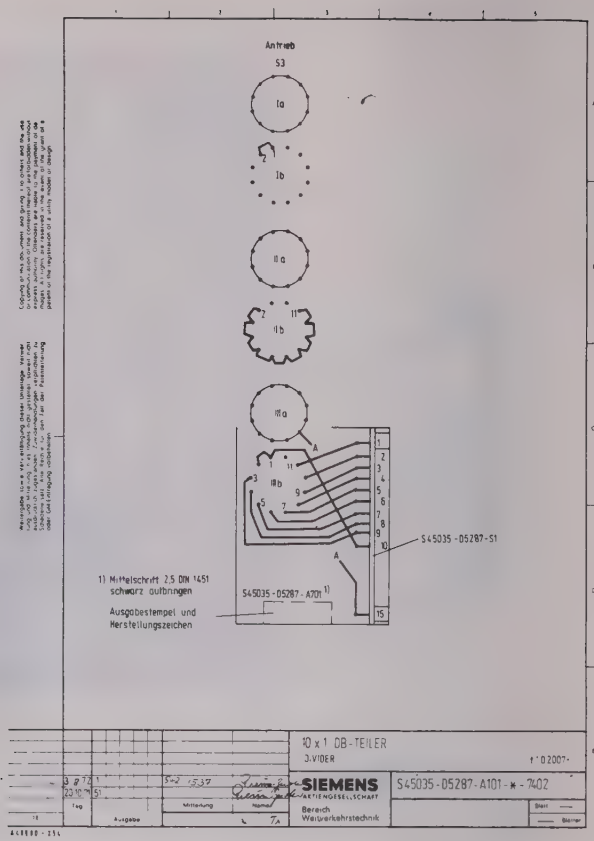
A4 8000-357

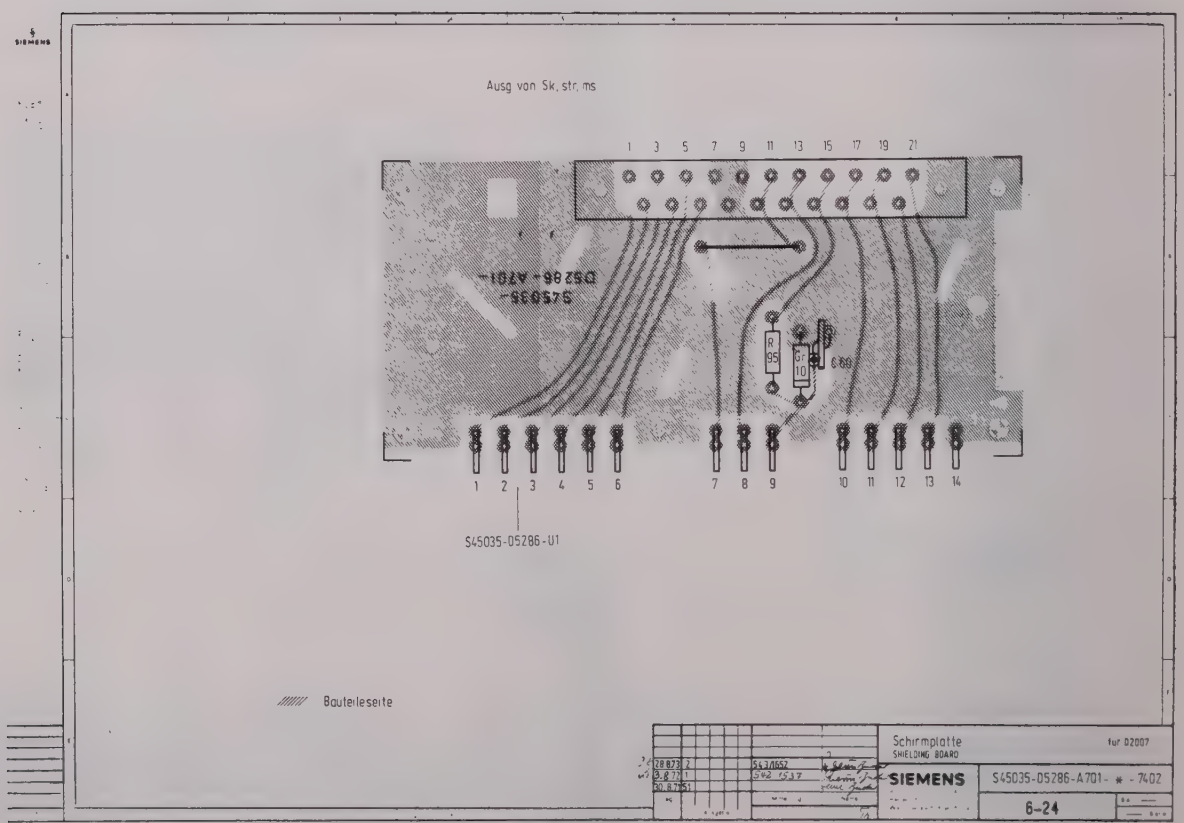

Ausgabe von Sk,str,ms
max Bauteilehöhe 11mm
S45035-WS146-U1
Phasenmodulator/Suchoszillator
PHASE MODULATOR/SEARCH FREQUENCY OSCILLATOR
für D2007
SIEMENS
S45035-D5282-A701-*-7402

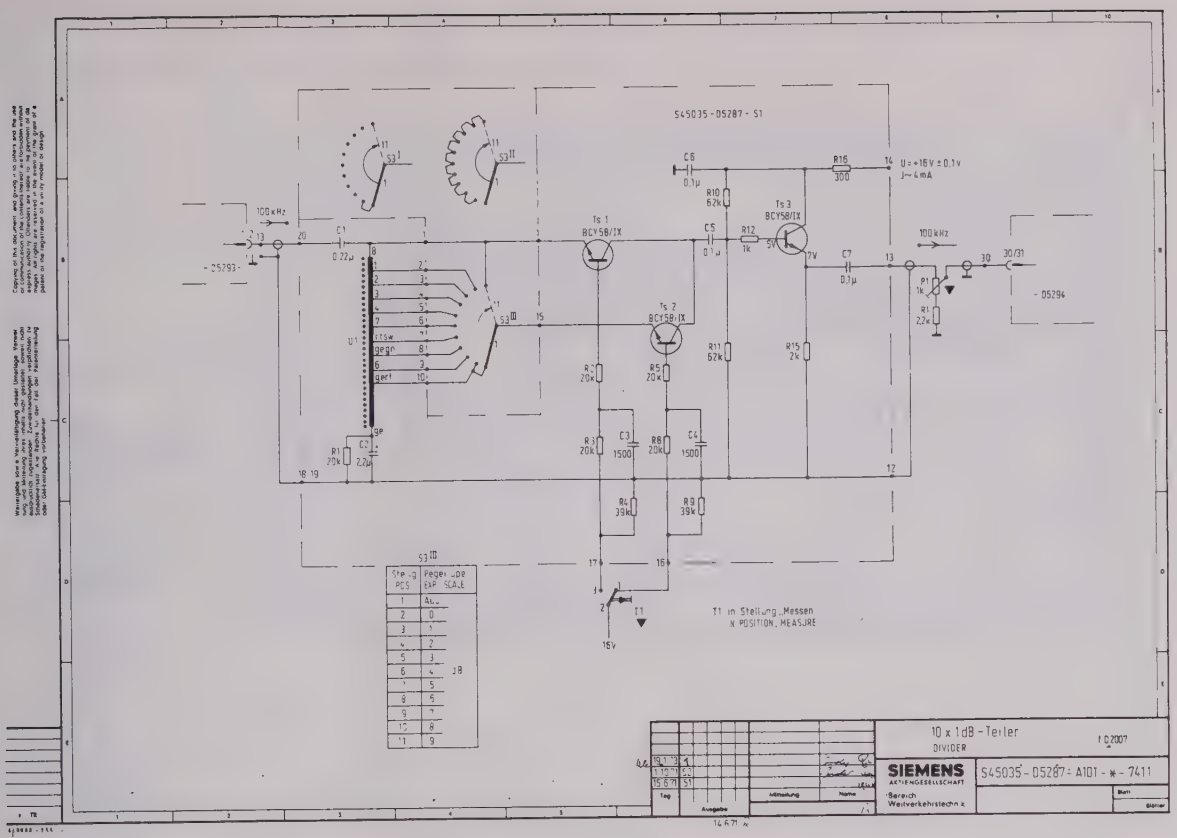

S45035-D5283-B301
S45035-D5284-B301
Bu1
Bu2
B1
B2
S45035-D5283-T1
B1,2: 2YCY0,4/2,5
1) Beschriftung in Mittelschrift 3 DIN 1451 schwarz aufbringen
2) Ausgabestempel
3) Herstellungszeichen
Bu26 1)
Bu25 1)
Beschriftung auf der Rückseite der Montagewanne neben den Buchsen aufbringen
Meßfeld
f D2007
SIEMENS
S45035-D5283-B301-*-7402
6-22

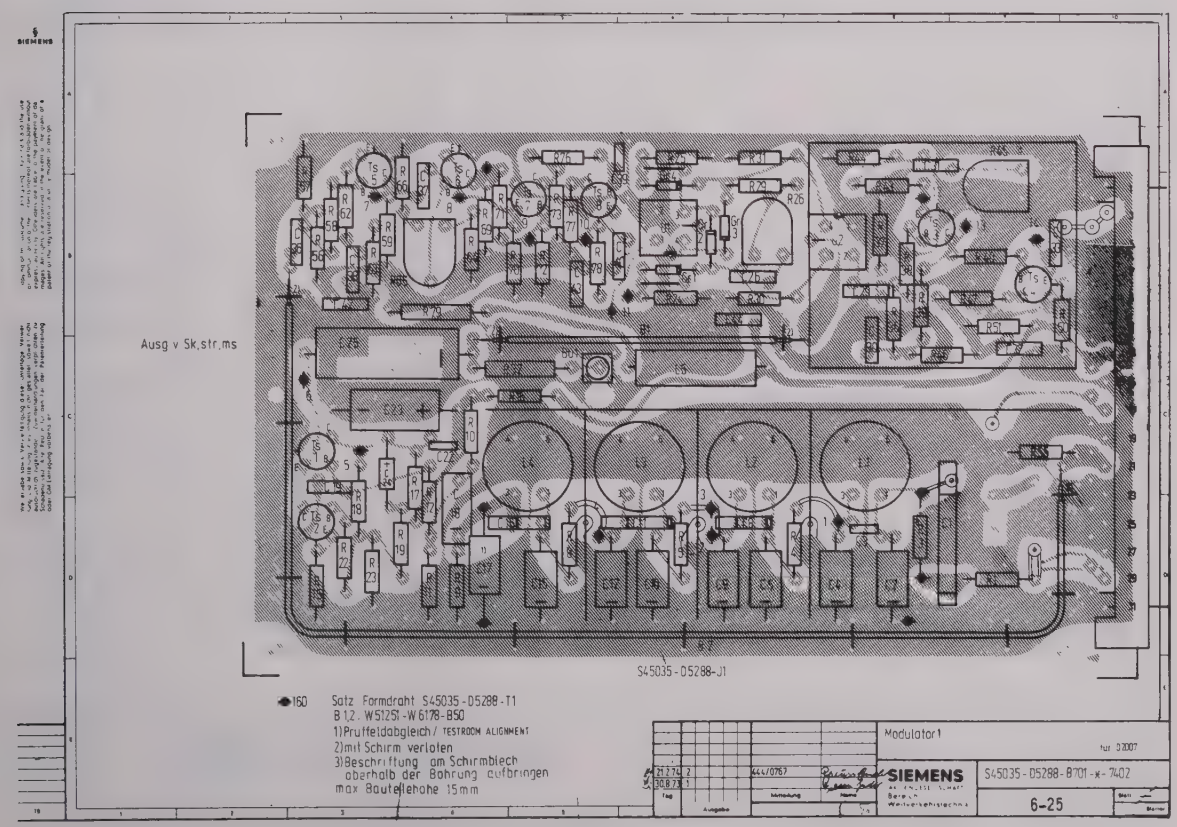
S 45035-D 5286-B 701
S 45035-05285-B 701
Ausg. v. Sk, str ms
S 45035-D 5284-
bekleben
mit Fol. 0,15 Hart-PVC bsm
Mellteld-Platte
für D 2007
SIEMENS
S 45035-D 5284-B-301-*-7402
Is
E
B
C
195
1) Halterung Sk Pos. 219
Bauteileseite
3) Abstand 4 mm
4) Abstand

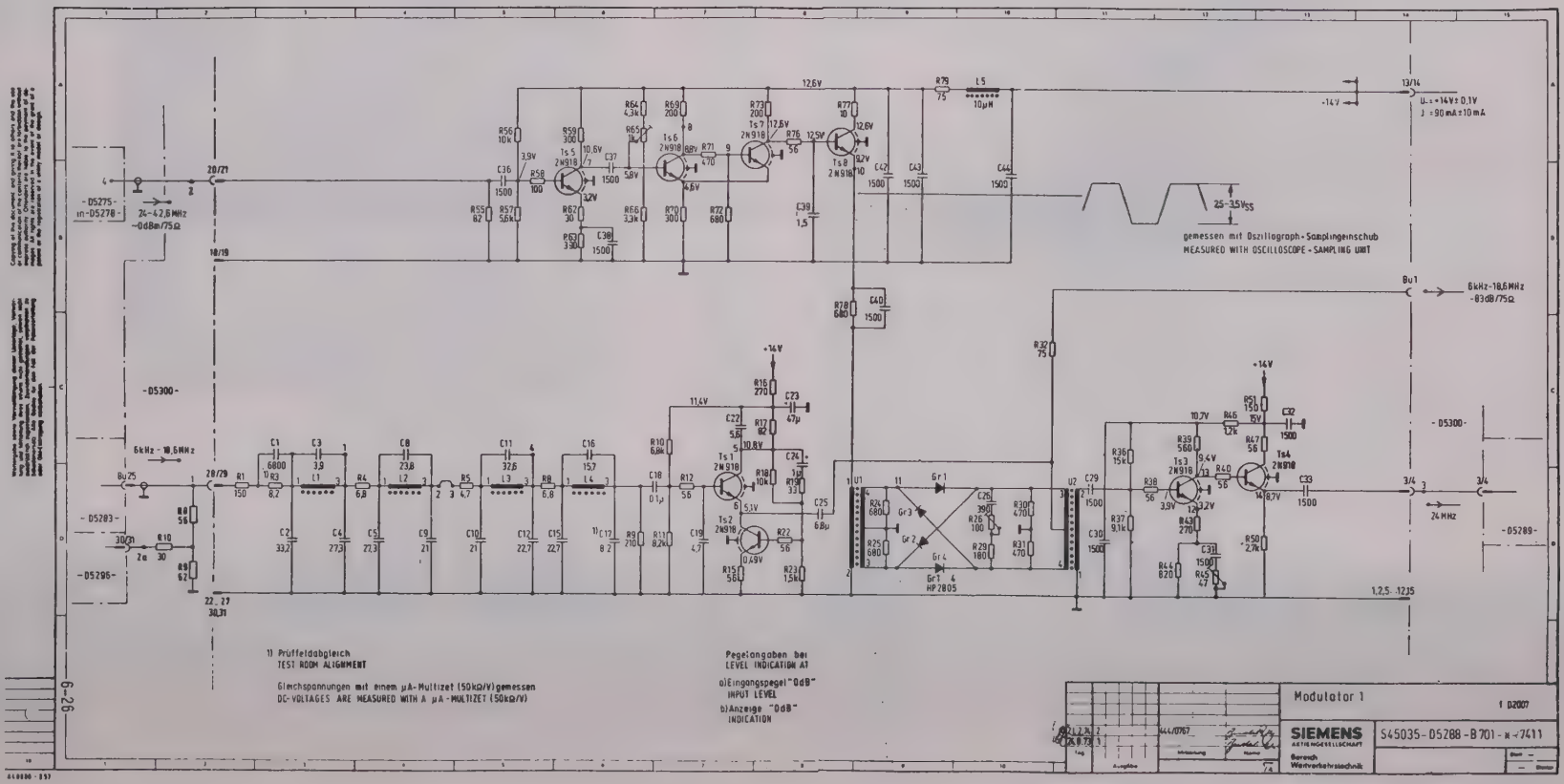

SIEMENS
Ausg. v. Sk, str ms
14 16 15 17 18 19 20 21
S45035-05285-
1 nicht im Rastermaß
SIEMENS
6-23

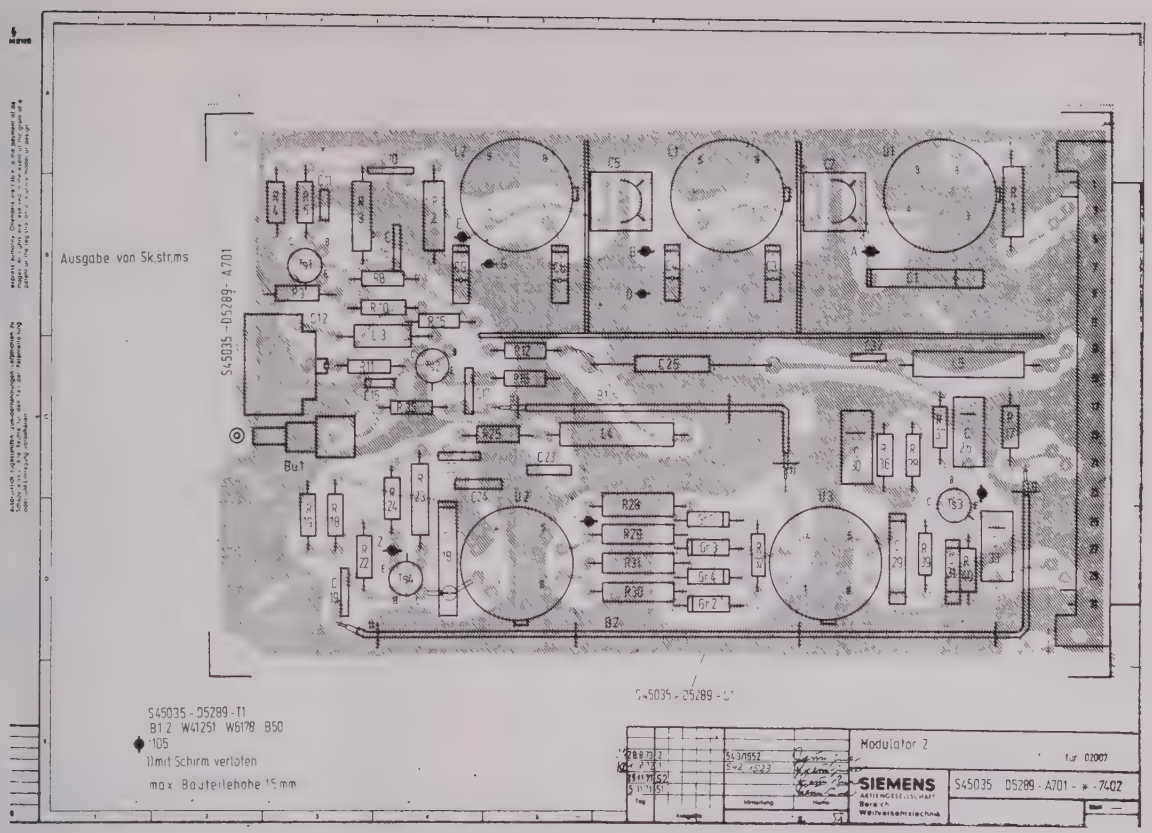

Antrieb
S3
1a
1b
II a
II b
III a
III b
S45035-05287-S1
S45035-05287-A701 1)
1) Mittelschrift 2,5 DIN 1451 schwarz aufbringen
Ausgabestempel und Herstellungszeichen
10 x 1 DB-TEILER
D.VIDER
für D2007
SIEMENS
AKTIENGESELLSCHAFT
S45035-D5287-A101-* - 7402
Bereich Weitverkehrstechnik

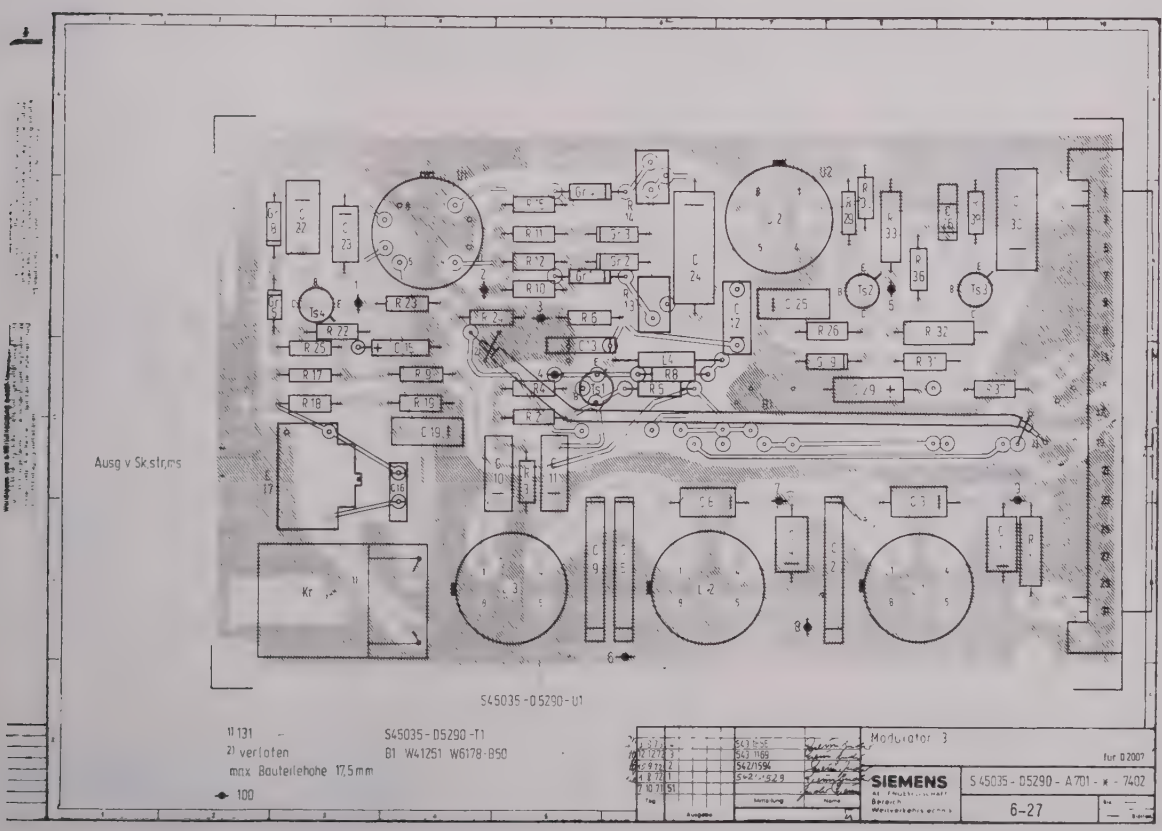

SIEMENS
Ausg von Sk, str, ms
1 3 5 7 9 11 13 15 17 19 21
S45035-D5286-A701-
R 95
C 10
S 69
1 2 3 4 5 6 7 8 9 10 11 12 13 14
S45035-05286-U1
Bauteileseite
Schirmplatte
SHIELDING BOARD
für D2007
SIEMENS
S45035-D5286-A701-* - 7402
6-24

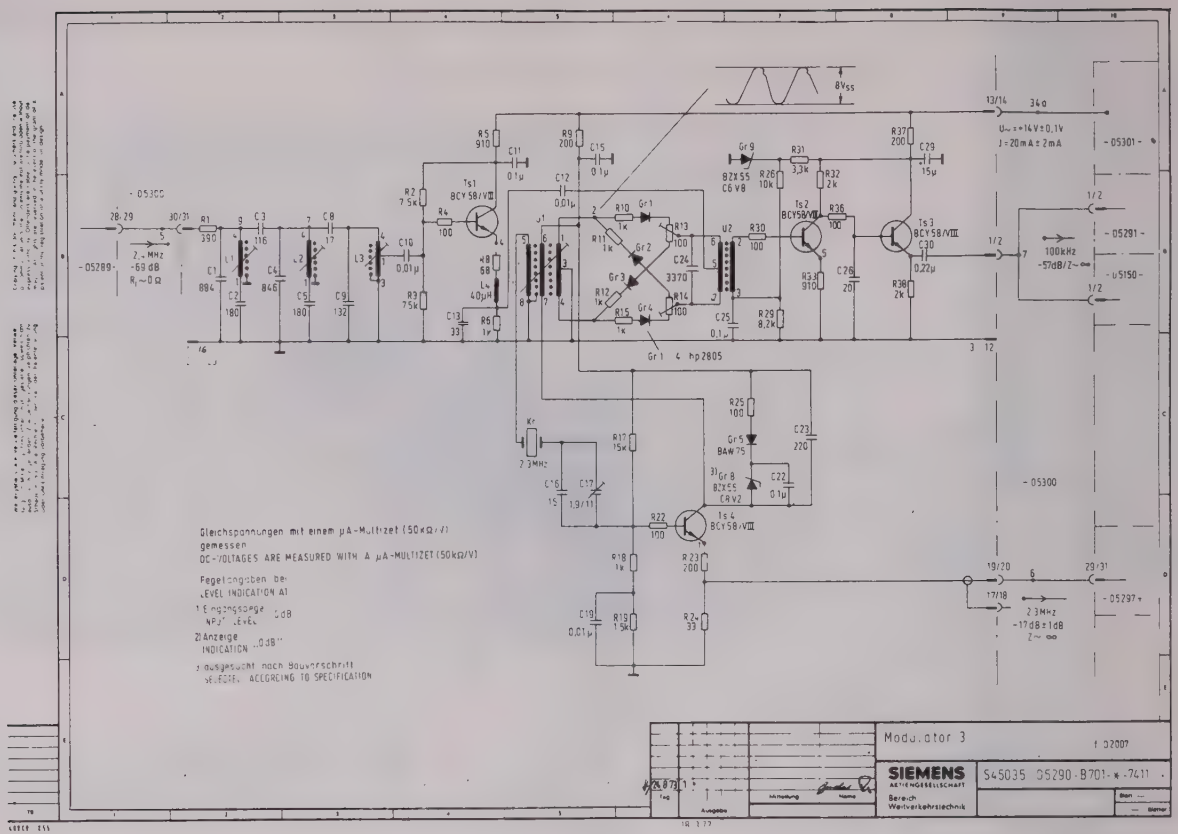

S45035-D5287-S1
100 kHz
C1 0.22µ
- D5293 -
S3 I
S3 II
S3 III
Ts 1 BCY58/IX
Ts 2 BCY58/IX
Ts 3 BCY58/IX
C6 0.1µ
R16 300
U = +15V ± 0.1v
I ~ 4mA
R10 62k
C5 0.1µ
R12 1k
5V
7V
C7 0.1µ
100 kHz
P1 1k
R1 2.2k
- D5294 -
R11 62k
R15 2k
R2 20k
R5 20k
R3 20k
C3 1500
R8 20k
C4 1500
R1 20k
C2 2.2µ
R4 39k
R9 39k
T1
T1 in Stellung „Messen"
IN POSITION „MEASURE"
15V
Pegel DE
EXP. SCALE
10 x 1dB - Teiler
DIVIDER
SIEMENS
AKTIENGESELLSCHAFT
S45035-D5287-A101-*-7411

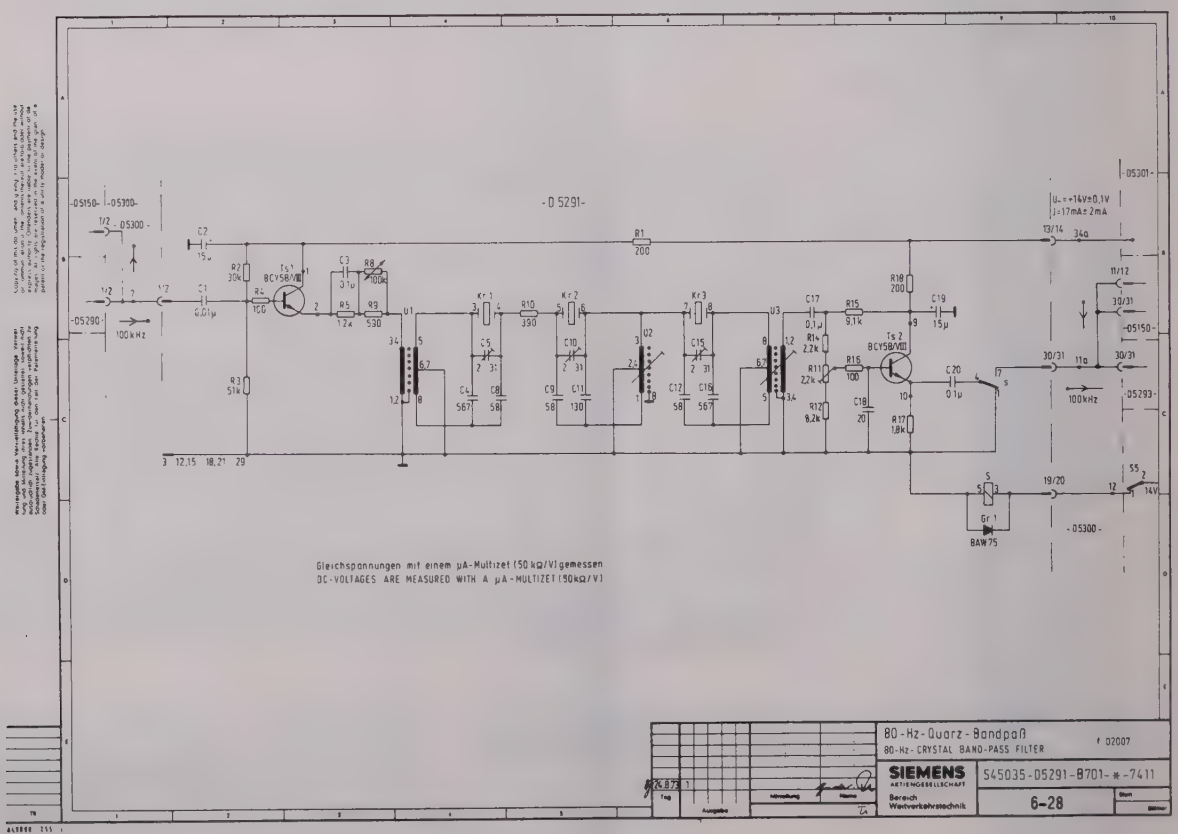

Ausg v Sk,str,ms
S45035-D5288-J1
160 Satz Formdraht S45035-D5288-T1
B 12. W5125I-W6178-B50
1) Pruffeldabgleich / TESTROOM ALIGNMENT
2) mit Schirm verloten
3) Beschriftung am Schirmblech
oberhalb der Bohrung aufbringen
max Bauteilehohe 15mm
Modulator1
SIEMENS
S45035-D5288-B701-*-7402
6-25

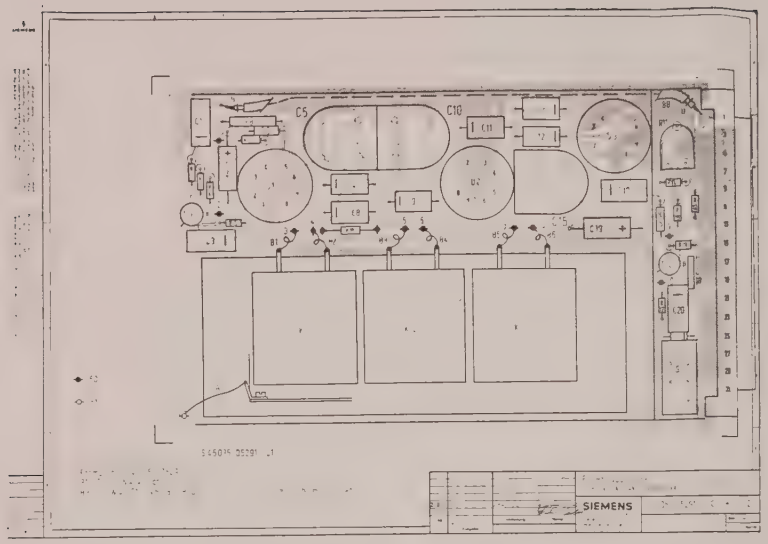

-D5275-
in-D5278-
24-42,6MHz
-0dBm/75Ω
-D5300-
6kHz-18,6MHz
-D5283-
-D5296-
-D5289-
24MHz
8kHz-18,6MHz
-03dB/75Ω
+14V
12,6V
11,4V
10,8V
5,3V
0,49V
25-35Vss
gemessen mit Oszillograph-Samplingeinschub
MEASURED WITH OSCILLOSCOPE-SAMPLING UNIT
U= +14V ± 0,3V
I = 90mA ± 10mA
HP2805
1) Prüffeldabgleich
TEST ROOM ALIGNMENT
Gleichspannungen mit einem µA-Multizet (50kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50kΩ/V)
Pegelangaben bei
LEVEL INDICATION AT
a) Eingangspegel "0dB"
INPUT LEVEL
b) Anzeige "0dB"
INDICATION
Modulator 1
1 D2007
SIEMENS
AKTIENGESELLSCHAFT
Bereich Wehrsprechtechnik
S45035-D5288-B701-A-7411

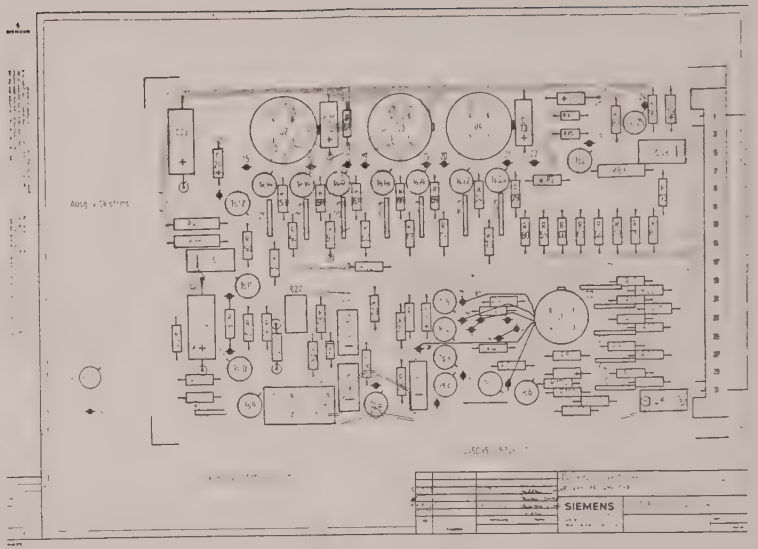

Ausgabe von Sk,str,ms
S45035 - D5289 - A701
S45035 - D5289 - U1
S45035 - D5289 - T1
B1 2 W41251 W6178 B50
105
1) mit Schirm verloten
max Bauteilehöhe 15 mm
Modulator 2
für D2007
SIEMENS
S45035 D5289 - A701 - * - 7402

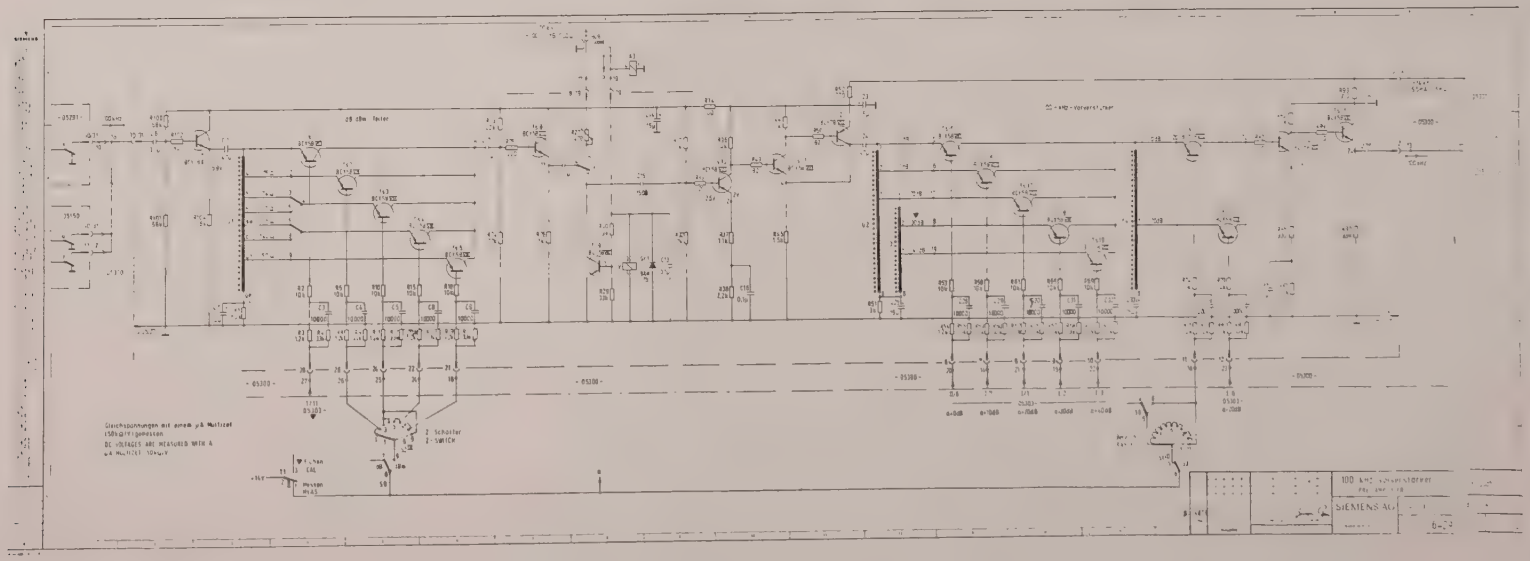

Ausg v Sk,str,ms
S45035 - D5290 - U1
S45035 - D5290 - T1
B1 W41251 W6178-B50
1) 131
2) verloten
max Bauteilehöhe 17,5 mm
100
Modulator 3
für D2007
SIEMENS
S 45035 - D5290 - A701 - * - 7402
6-27

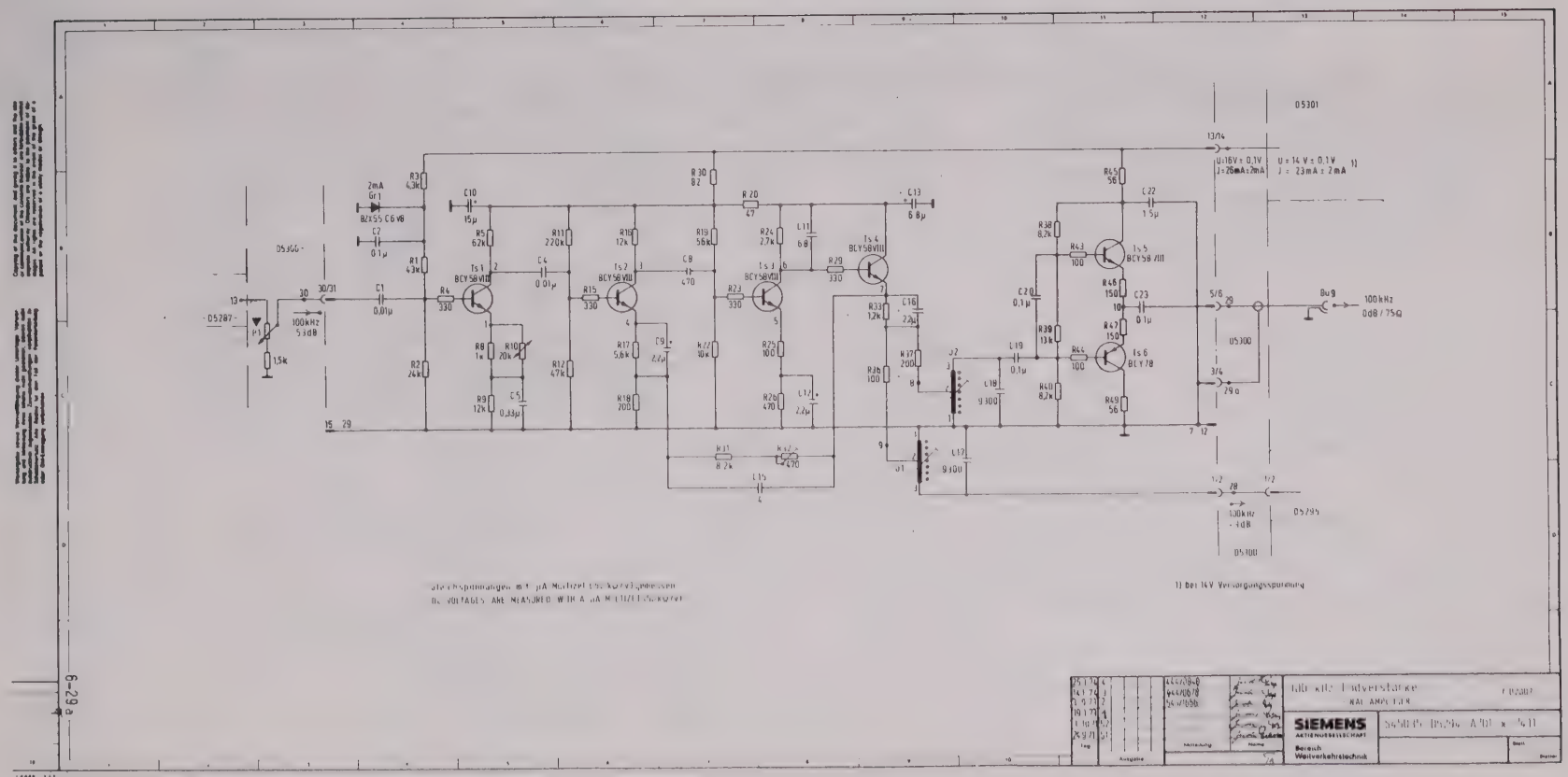

Modulator 3
SIEMENS
S45035 - D5290 - B701 - * - 7411
Gleichspannungen mit einem µA-Multizet (50 kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50kΩ/V)
- 05300
- 05289 -
- 05301 -
- 05291 -
- u5150 -
- 05297 -
Gr1 ... Gr4 hp2805
2,3MHz
100kHz


80-Hz-Quarz-Bandpaß
80-Hz-CRYSTAL BAND-PASS FILTER
SIEMENS
S45035 - D5291 - B701 - * - 7411
6-28
- D5291 -
- 05150 -
- 05300 -
- 05301 -
- 05293 -
100kHz
Gleichspannungen mit einem µA-Multizet (50 kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50kΩ/V)


SIEMENS


SIEMENS

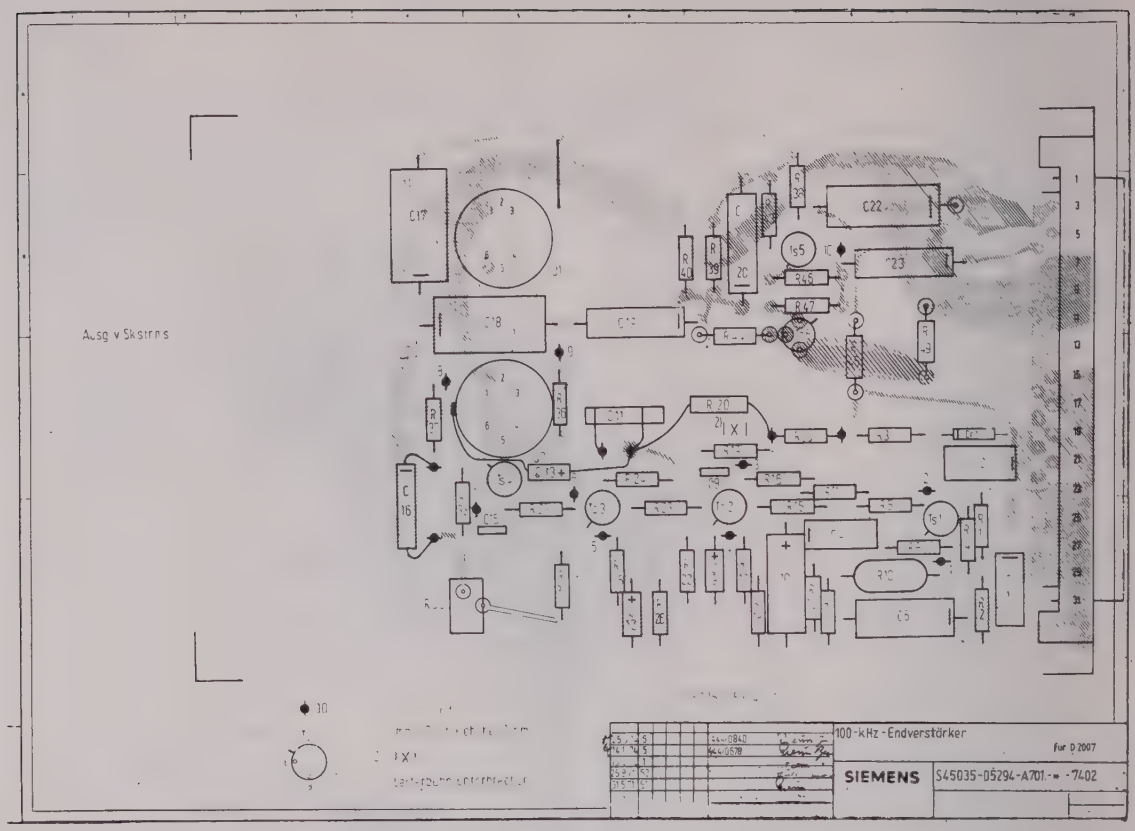

SIEMENS AG

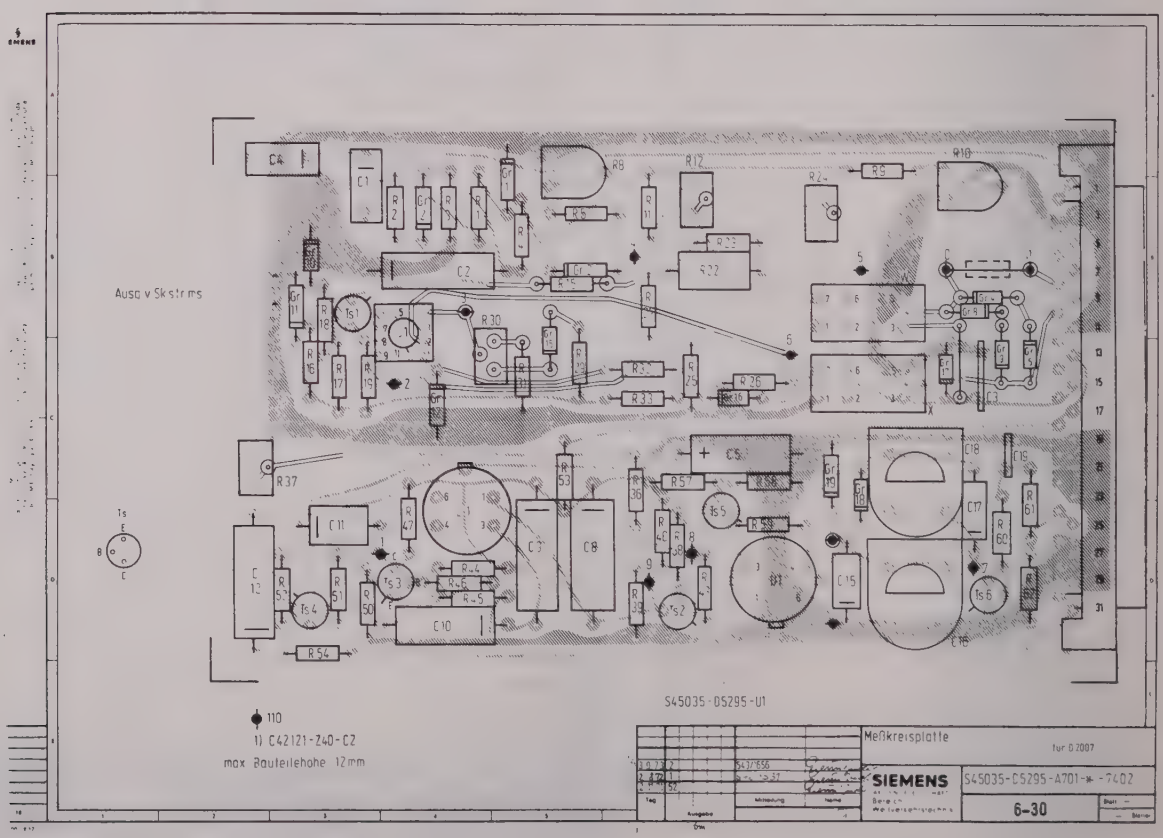


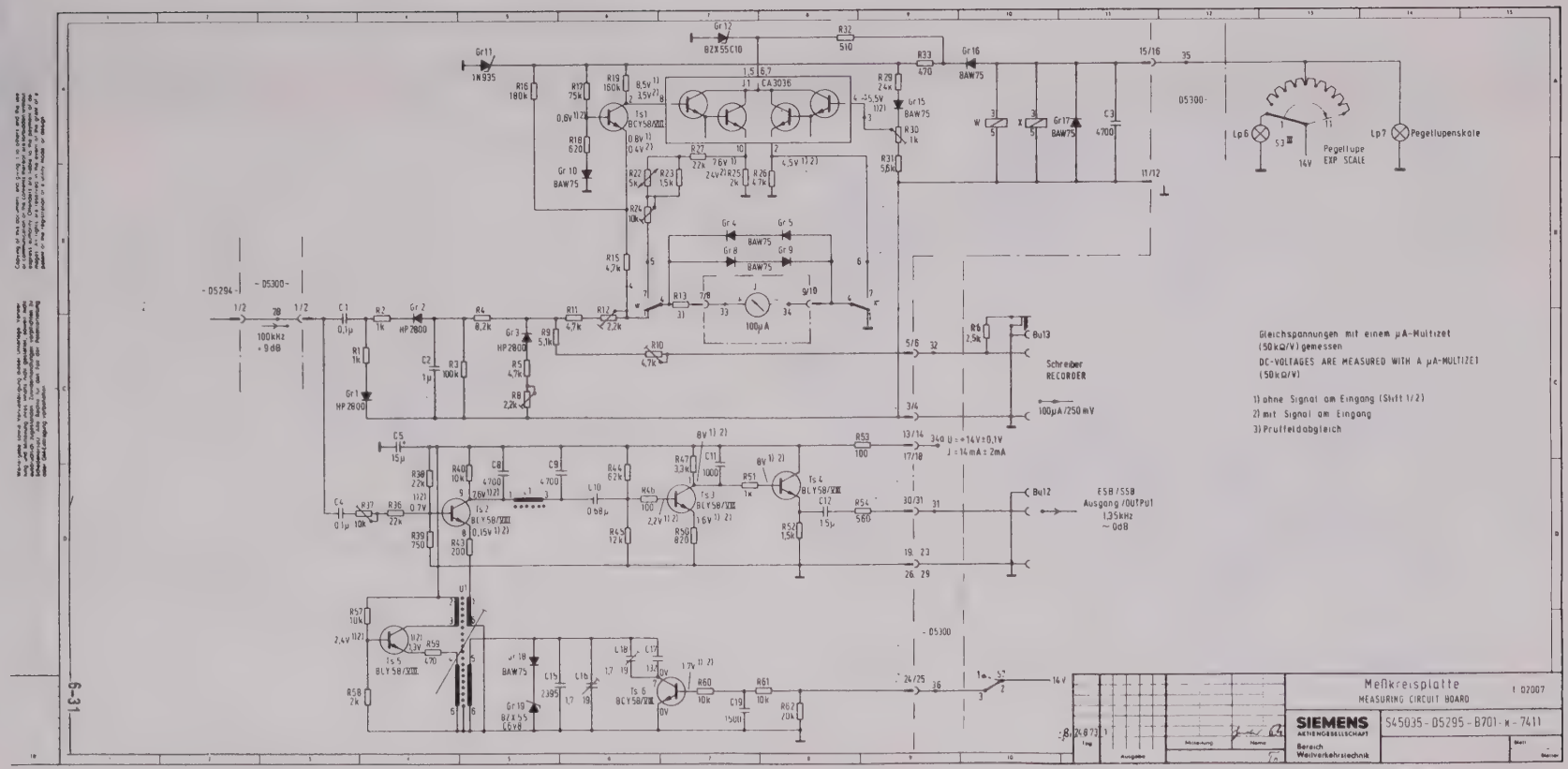
100 kHz Endverstärker
FINAL AMPLIFIER

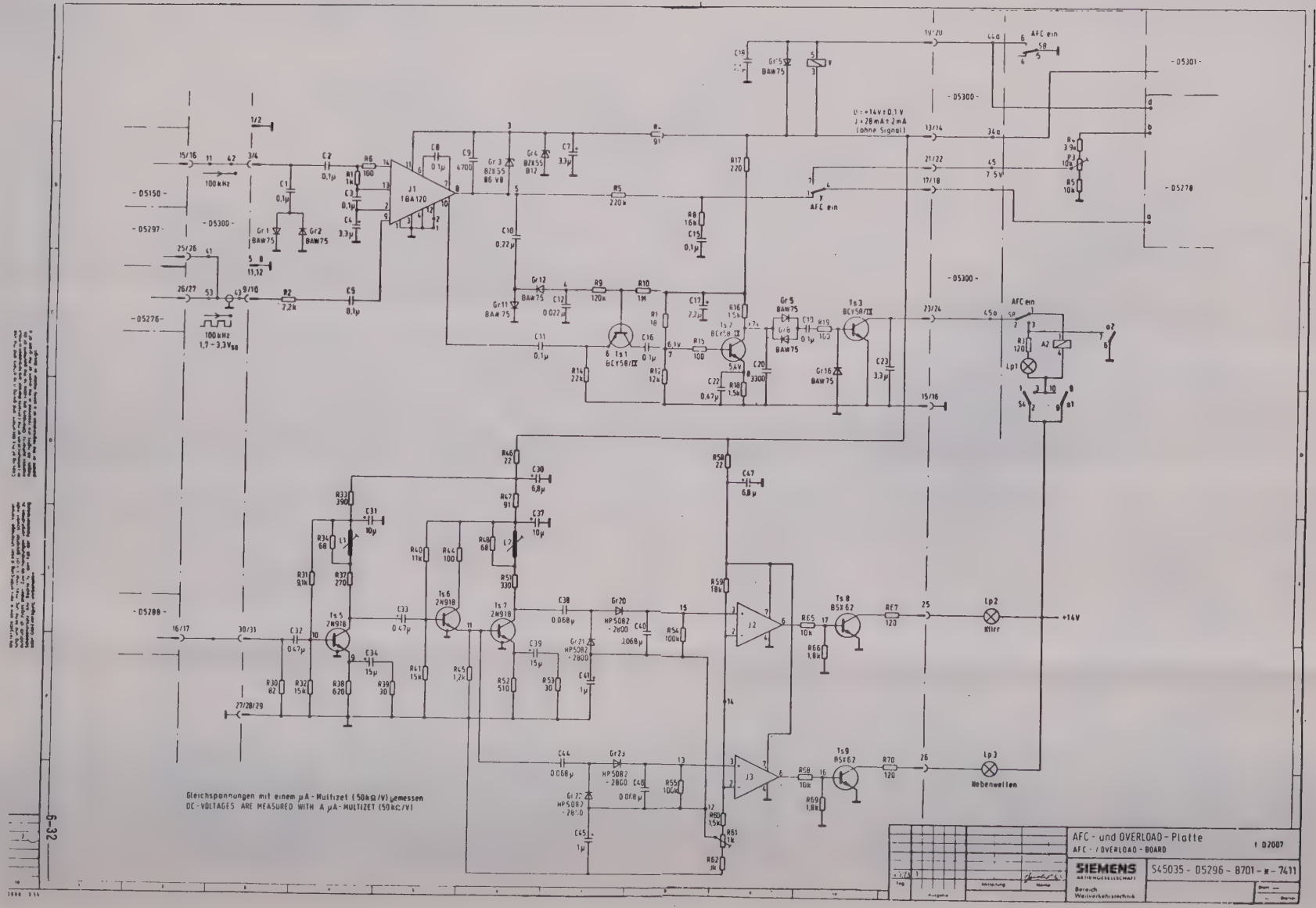
SIEMENS
AKTIENGESELLSCHAFT
Bereich
Weitverkehrstechnik

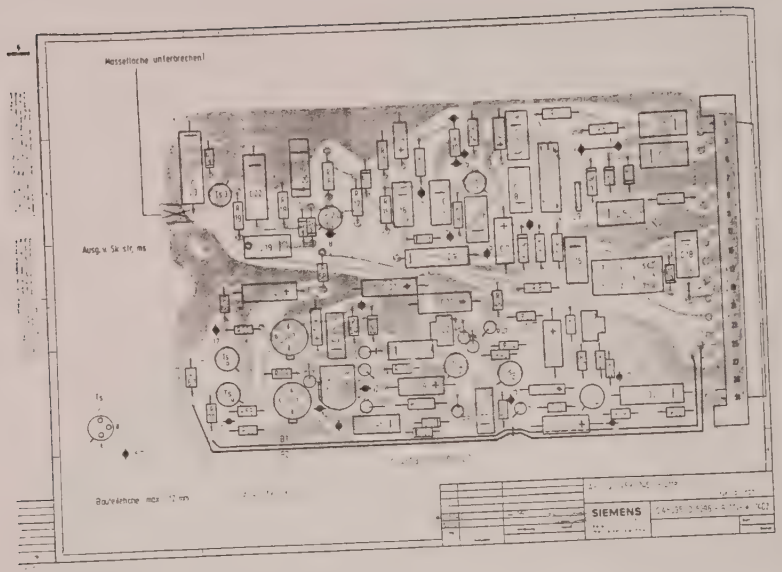
6-29a

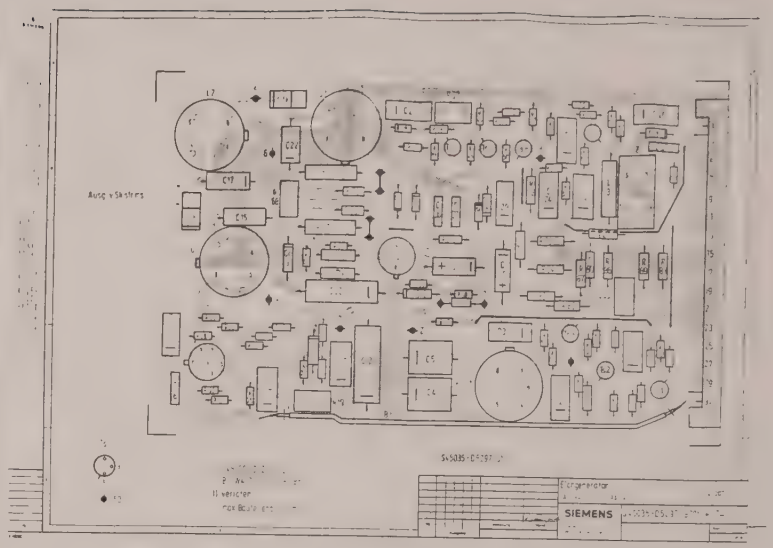

Ausg v Sk strms
100-kHz-Endverstärker
für D 2007
SIEMENS
S45035-D5294-A701-*-7402

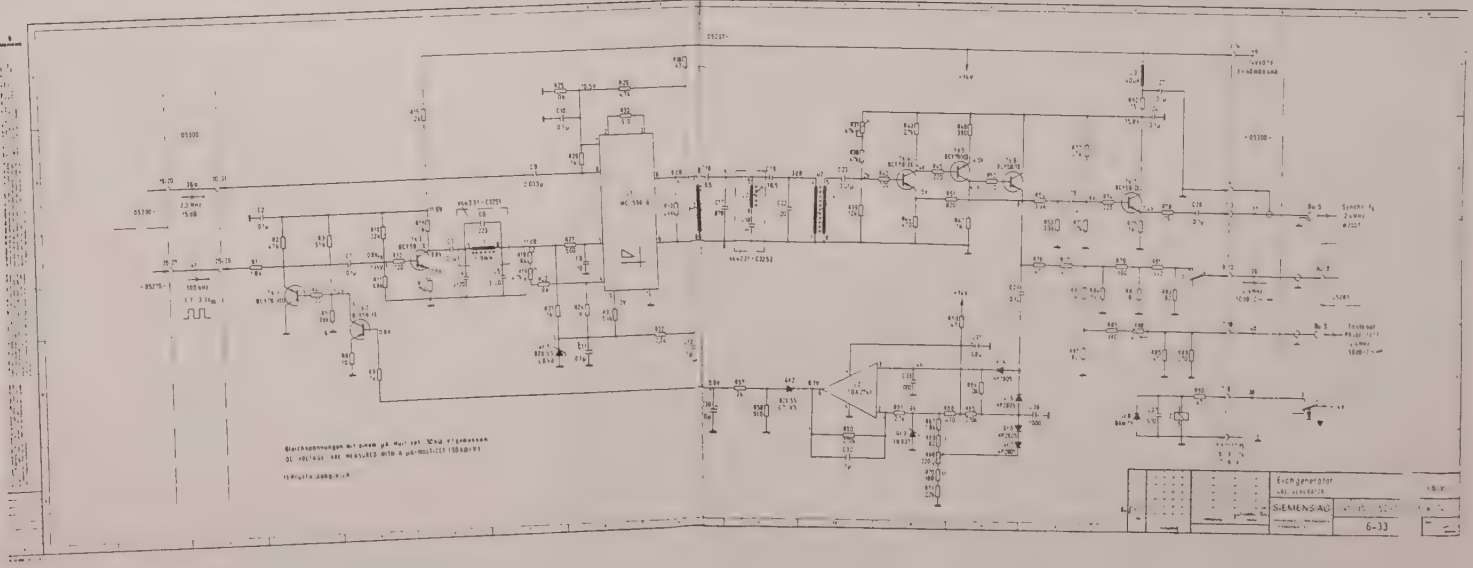

Ausg v Sk strms
S45035-D5295-U1
1) C42121-Z40-C2
max. Bauteilehöhe 12mm
Meßkreisplatte
für D 2007
SIEMENS
S45035-C5295-A701-*-7402
6-30

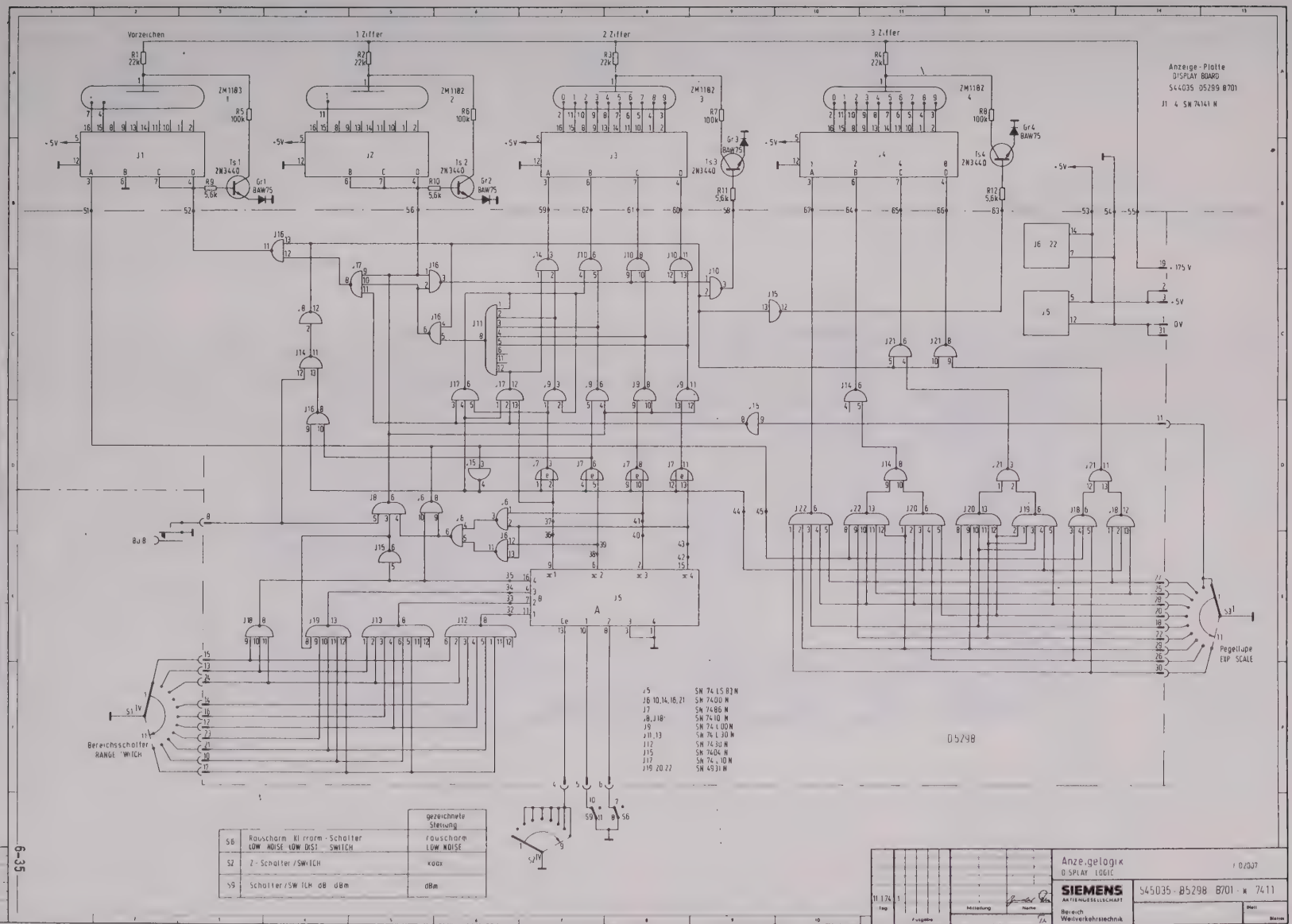

Gleichspannungen mit einem µA-Multizet (50kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50kΩ/V)
1) ohne Signal am Eingang (Shift 1/2)
2) mit Signal am Eingang
3) Prüffeldabgleich
Meßkreisplatte
MEASURING CIRCUIT BOARD
E 02007
SIEMENS
AKTIENGESELLSCHAFT
Bereich Weitverkehrstechnik
S45035-D5295-B701-W-7411
Blatt
Meßkreisplatte
MEASURING CIRCUIT BOARD
E 02007
SIEMENS
AKTIENGESELLSCHAFT
Bereich Weitverkehrstechnik
S45035-D5295-B701-W-7411
Blatt

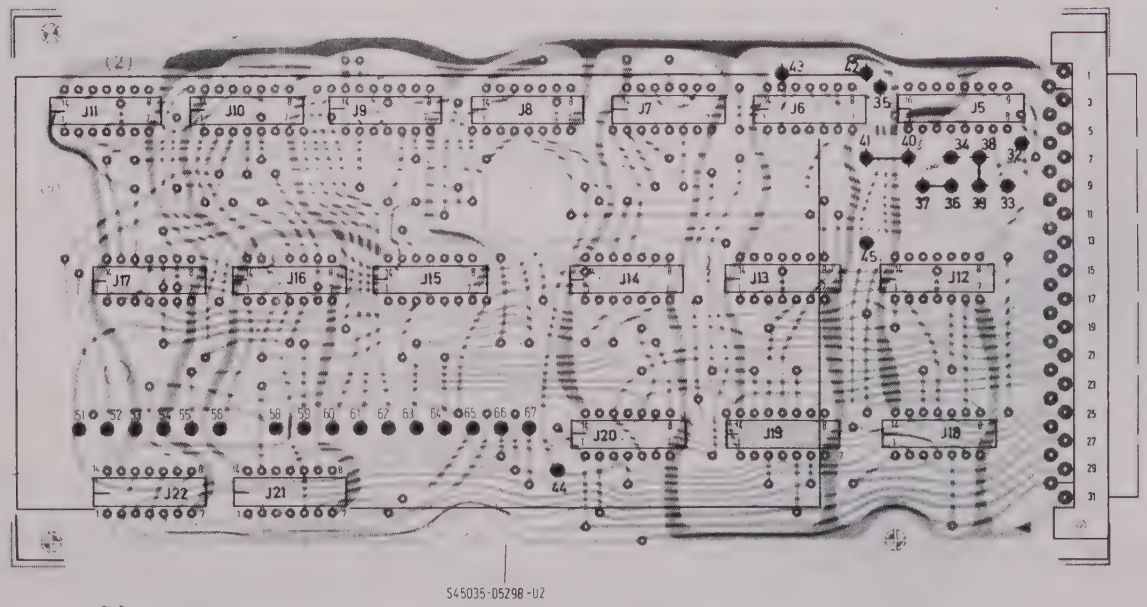

AFC ein
- D5301 -
- D5300 -
- D5270
- D5150 -
- D5297 -
- D5276 -
- D5288 -
100 kHz
100 kHz
1,7 - 3,3 Vss
U = +14 V ± 0,1 V
I = 28 mA ± 2 mA
(ohne Signal)
7,5 V
5,4 V
6,1 V
+14 V
Mirr
Lp1
Lp2
Lp3
Nebenwellen
Gleichspannungen mit einem µA-Multizet (50 kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50 KΩ/V)
AFC - und OVERLOAD - Platte
AFC - / OVERLOAD - BOARD
t 02007
SIEMENS
S45035 - D5296 - B701 - H - 7411
Bereich Weitverkehrstechnik


Messstecke unterbrechen!
Ausg. v. Sk. str. ms
Bauvérénche max 12 mm
SIEMENS


Ausg v Sk strms
SIEMENS


Eichgenerator
SIEMENS AG
6-33


Vorzeichen
1 Ziffer
2 Ziffer
3 Ziffer
Anzeige-Platte
DISPLAY BOARD
S45035 05298 B701
J1 4 SN 74141 N
ZM1183
ZM1182
Ts1
Ts2
Ts3
Ts4
2N3440
Gr1
Gr2
Gr3
Gr4
BAW75
R1 22k
R2 22k
R3 22k
R4 22k
R5 100k
R6 100k
R7 100k
R8 100k
R9 5,6k
R10 5,6k
R11 5,6k
R12 5,6k
+5V
J1
J2
J3
J4
J5
J6 22
J15
J16
J17
J14
J21
J22
J20
J19
J18
J10
J11
J12
J13
J8
J9
J7
175 V
5V
0V
8J8
Bereichsschalter
RANGE SWITCH
Pegellupe
EXP SCALE
05298
J5 SN 74 LS 82 N
J6 10,14,16,21 SN 7400 N
J7 SN 7486 N
J8,J18 SN 7410 N
J9 SN 74 L 00 N
J11,13 SN 74 L 30 N
J12 SN 7430 N
J15 SN 7404 N
J17 SN 74 L 10 N
J19,20,22 SN 4931 N
S6 Rauscharm Klirrarm-Schalter LOW NOISE LOW DIST SWITCH rauscharm LOW NOISE
S2 Z-Schalter/SWITCH koax
S9 Schalter/SW TCH dB dBm dBm
gezeichnete Stellung
Anze,gelogik
DISPLAY LOGIC
SIEMENS
AKTIENGESELLSCHAFT
Bereich Weitverkehrstechnik
S45035-B5298 B701 - W 7411
6-35



Anzeigelogik

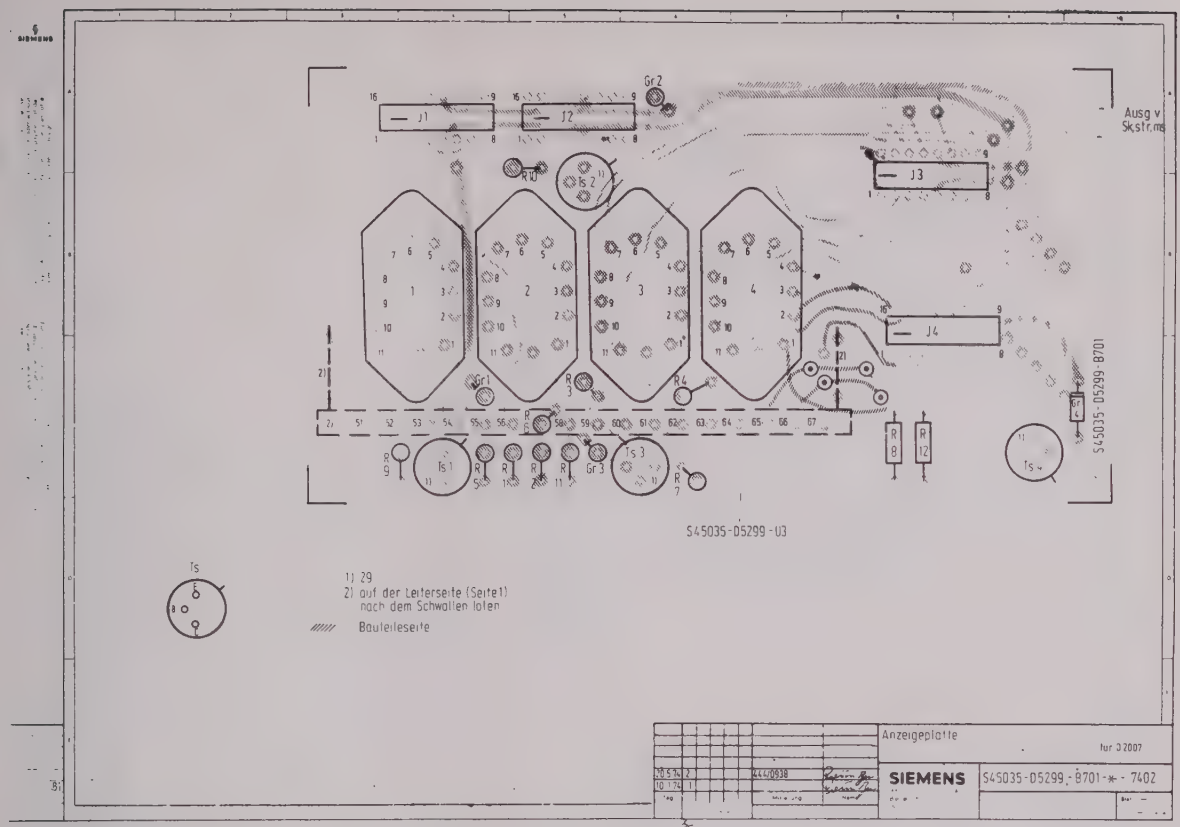
für 0 2007

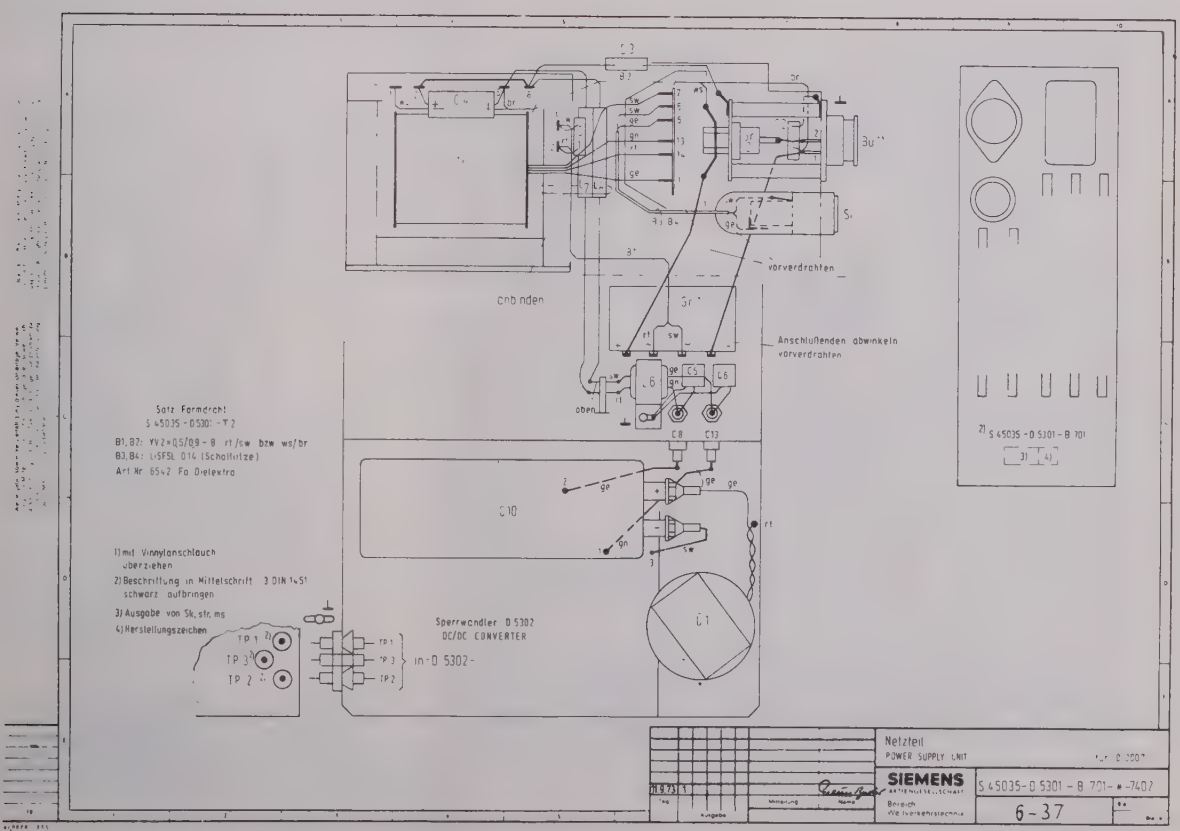
SIEMENS AKTIENGESELLSCHAFT

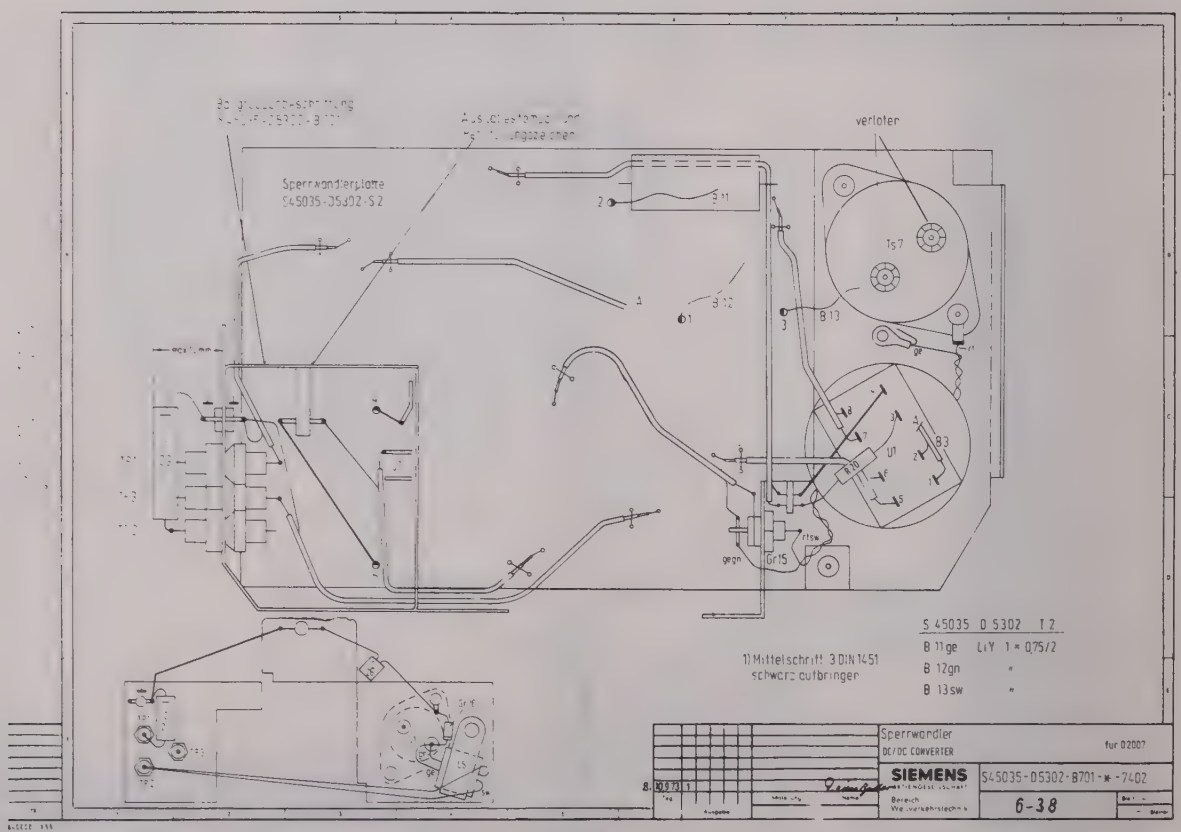
Bereich Wechselverkehrstechnik

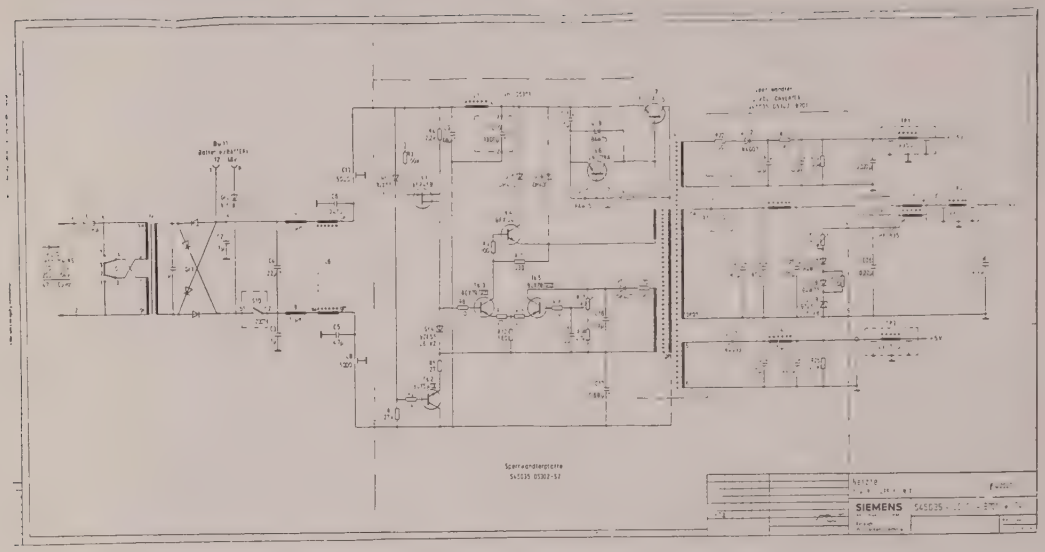
S45035-05298 B701-*-7402

6-3 6


Gr2
J1
J2
J3
J4
Ts 2
Ts 1
Ts 3
Ts 4
Gr1
Gr3
R 10
R 4
R 3
R 9
R 7
R 8
R 12
Ausg v Sk.str.ms
S45035-D5299-B701
S45035-D5299-U3
Ts
1) 29
2) auf der Leiterseite (Seite1) nach dem Schwallen löten
Bauteileseite
Anzeigeplatte
für D 2007
SIEMENS
S45035-D5299-B701-*-7402


C2
C4
C5
C6
C8
C13
C10
C1
vorverdrahten
anbinden
Anschlußenden abwinkeln vorverdrahten
oben
Satz Formdraht
S 45035-D5301-T2
B1,B2: YV2×0,5/0,9-8 rt/sw bzw ws/br
B3,B4: LiSFSL 0,14 (Schallitze)
Art.Nr 65x2 Fa. Dielextra
1) mit Vinylanschlauch überziehen
2) Beschriftung in Mittelschrift 3 DIN 1451 schwarz aufbringen
3) Ausgabe von Sk.str.ms
4) Herstellungszeichen
Sperrwandler D 5302
DC/DC CONVERTER
in D 5302
TP 1
TP 3
TP 2
S45035-D5301-B701
Netzteil
POWER SUPPLY UNIT
SIEMENS
S45035-D5301-B701-*-7402
6-37


verloter
Sperrwandlerplatte
S45035-D5302-S2
S 45035 D 5302 T 2
B 11 ge LiY 1 x 0,75/2
B 12 gn "
B 13 sw "
1) Mittelschrift 3 DIN 7451
schwarz aufbringen
Sperrwandler
DC/DC CONVERTER
für 02007
SIEMENS
S45035-D5302-B701-W-7402
6-38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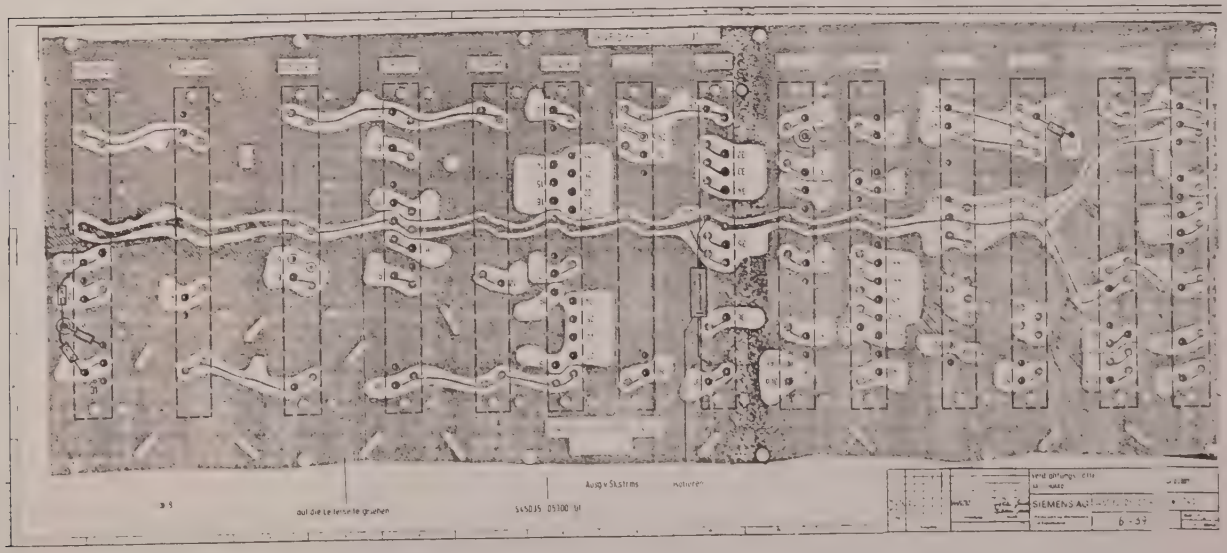
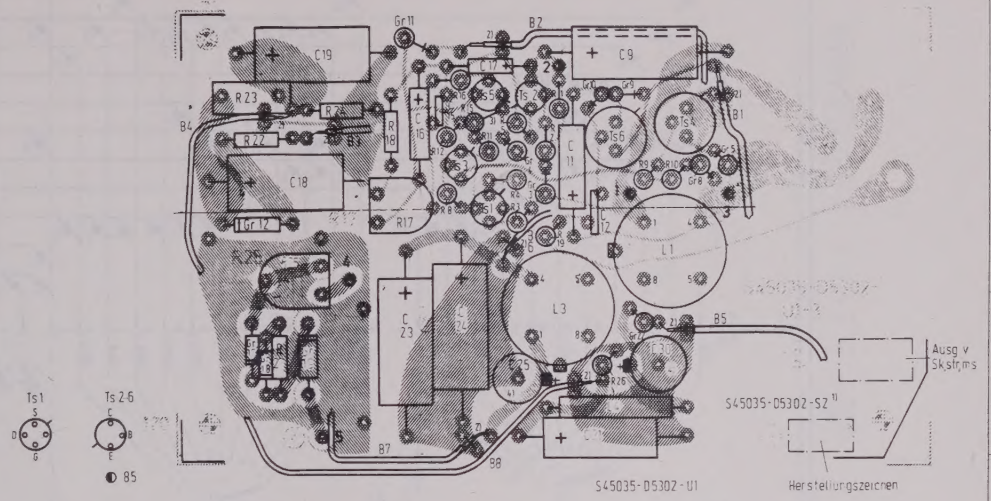

SIEMENS AG
6-37

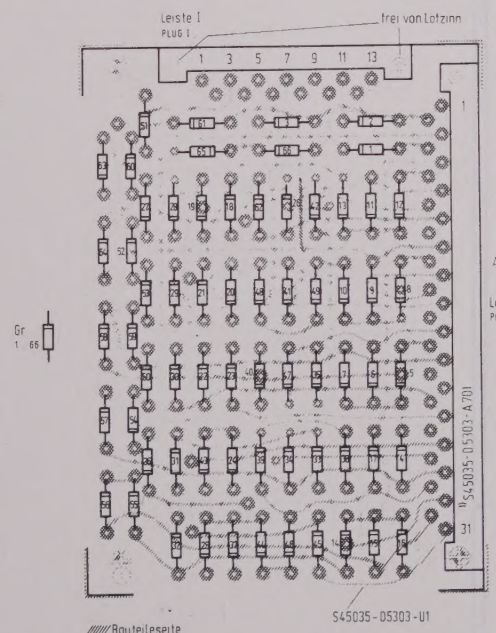


S45035-D5302-T1
B1 8 : W41251-W6178-B50 (nur ein Leitungsende einschwalen)

1) Mittelschrift 3 DIN 1451 schwarz aufbringen
2) verlaten
3) Anschlußdraht von R15 isolieren
4) 83

////// Bauteileseite

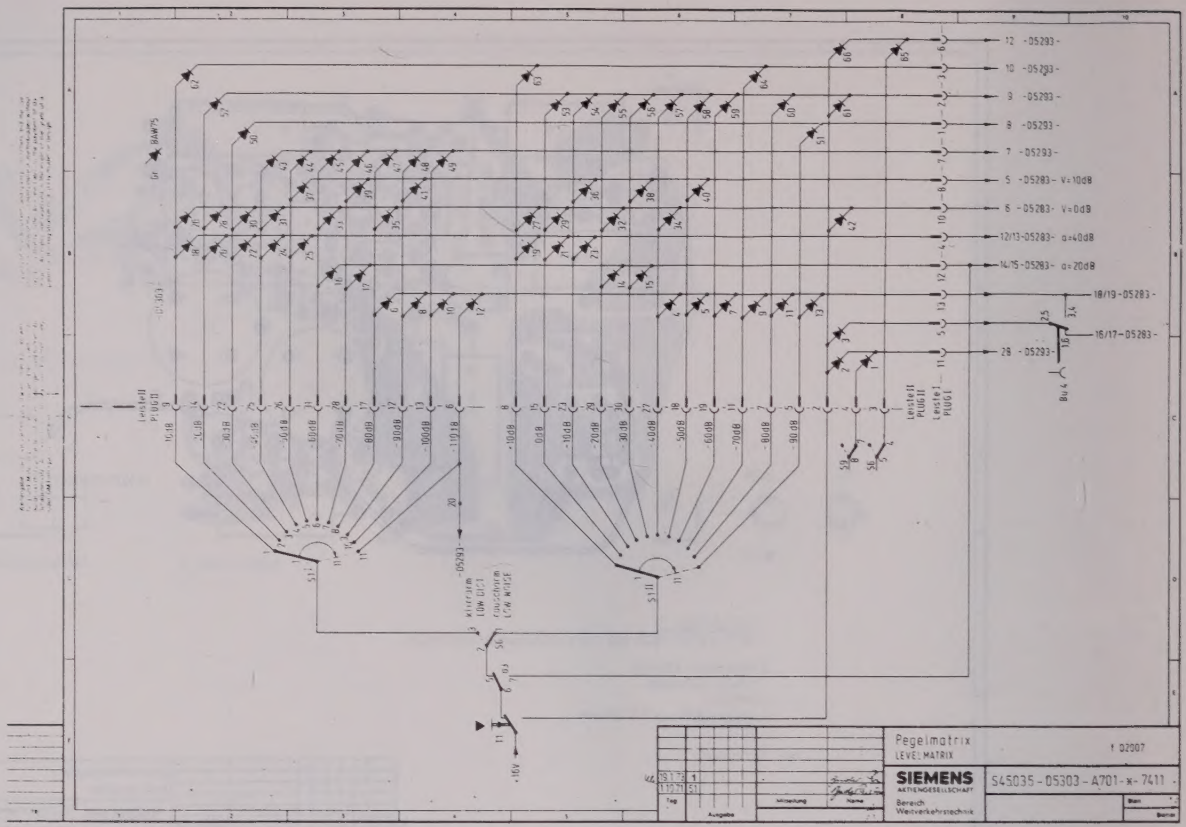
	Sperrwandlerplatte DC/DC CONVERTER	für D 2007
18 973 1	SIEMENS	S45035-D5302-S2-*-7402

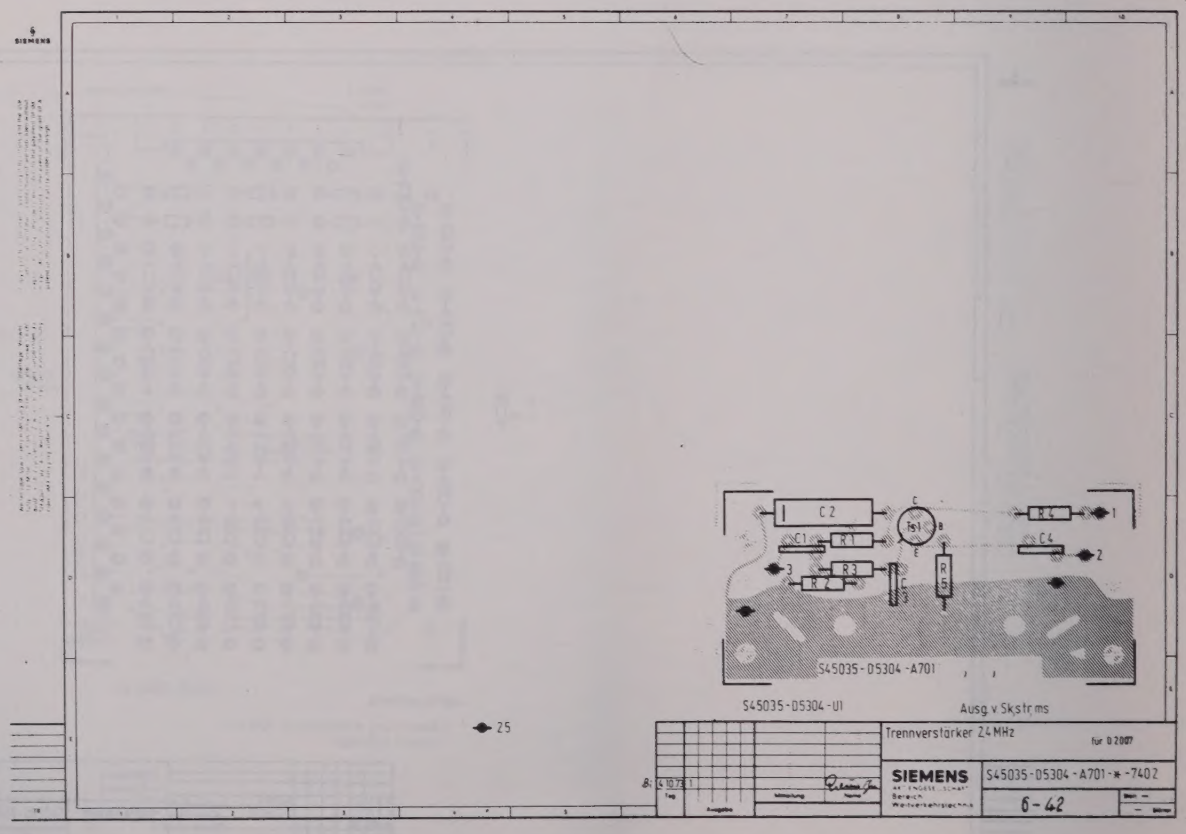


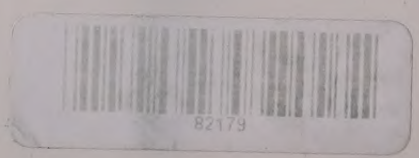
////// Bauteileseite

1) Beschrittung in Mittelschrift 3 DIN 1451 schwarz aufbringen

	Pegelmatrix LEVELMATRIX	f. D2007
18 973 2 C 272 1 24 KP2 S1	5437/1673 5437/1529	SIEMENS
		S45035-D5303-A701-*-7402
		6-41


Pegelmatrix
LEVEL MATRIX
SIEMENS
S45035-D5303-A701-x-7411


S45035-D5304-A701
S45035-D5304-U1
Ausg.v Skstrms
Trennverstärker 24 MHz
SIEMENS
S45035-D5304-A701-*-7402
6-42


82179